

PC MAGAZINE

VOLUME 6 NUMBER 22
DECEMBER 22, 1987

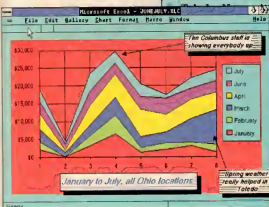
UTILITIES: FREE PROGRAM
PRN2FILE.COM TAMES PRINTER
OUTPUT FROM ANY SOURCE

Microsoft Excel: The Best Spreadsheet Ever?

Windows Power!

- Quartz Does Databases
- Graph Makes It Beautiful
- Excel Challenges Lotus

	File	Edit	Formula	Format	Data	Options	Macro	Window	
	D2		=SUM(E2:J2)						
	A	B	C	D	E	F			
1	Store Nets	Manager	1st name	TOTALS	January	February			
2	Akron	McCoy	Alan	\$18,879	\$2,181	\$2,091	\$		
3	Cincinnati	Poloncio	Steve	\$4,252	(\$113)	(\$81)	\$		
4	Cleveland	Waltzman	Lisa	\$23,386	\$3,191	\$2,819	\$		
5	Columbus	Ivies	Elena	\$29,650	\$6,518	\$5,132	\$		
6	Dayton	Collins	Joseph	\$20,447	\$1,281	\$1,321	\$		
7	Springfield	Branches	Jill	\$17,403	\$2,101	\$1,819	\$		
		Quartz	Henry	\$22,188	\$3,101	\$1,021	\$		
		Jensen	Terry	\$24,493	\$1,318	\$2,101	\$		
				\$43,372	\$3,499	\$4,192	\$1		



OHIO.XLS		1 of 12
Store Nets:	Akron	New
Managers:	McCoy	Delete
1st names:	Alan	Restore
TOTALS:	\$18,879	Find Prev
January:	2181	Find Next
February:	2091	Criteria
March:	3548	Exit
April:	4321	
June:	3521	
July:	3217	

- VGA Resolution Now: 16 EGA Plus Cards

- Performance for the Future: PC Labs Tests 9 Fast, Affordable 386-based PCs

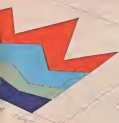
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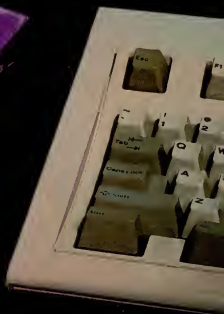
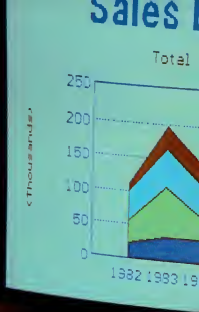


Sales by Division



1984	1985
21,456.00	35,905.00
62,118.67	86,172.25
5,000.00	345,087.00
122.67	169,727.75
0.00	42,000.00
0.00	124,048.00
	41,021.00
	141,044.75

1985



Quattro: The Professional Spreadsheet



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VOLUME 6 NUMBER 22

WHAT'S INSIDE

Ever since Microsoft brought *Windows* to market 2 years ago, developers have treated it as a new environment, writing programs that run within its graphics interface. Many of those programs, including Aldus's *PageMaker*, have come over to the PC from the Macintosh.

This year Microsoft brought its own application, *Microsoft Excel*, to the PC from the Mac—where the spreadsheet outsells Lotus Development Corp.'s *1-2-3* by more than two to one.

In a year in which other software giants are challenging *1-2-3* (like Borland with its spreadsheet, *Quattro*), the move caught the attention of market analysts and boosted the visibility of *Windows* as a developer's tool.

At the September press conference in which *Microsoft Excel* was formally unveiled, a number of other companies joined Microsoft to announce new *Windows* products. In this issue, you'll read about *Excel* and three state-of-the-art *Windows* products—Blyth Software's new database *Omnis Quartz*, Micrografx's *Windows Graph*, and *ClickStart*, a menu-generator program from hDC Computer.

These are the most recent of many new *Windows* products finding their way to market. Two technical-drawing packages—*Illustrator*, from Adobe Systems, and *Designer*, from Micrografx—were to be released this month.

RESIDENT EXPERTS Also in this issue, *PC Magazine* staff editors Jonathan Matzkin and Catherine D. Miller take a



Notes, memos, reminders: staff editors Catherine D. Miller and Jonathan Matzkin review six note-taking programs in this issue.

look at RAM-resident note-taking programs. Some are cell notation programs designed for use with *Excel*'s DOS competitor, *1-2-3*. Others are generic note-takers, handy devices that can be used with any program, including the new *Windows* products.

Leading off this issue's Productivity section, in the PC Lab Notes column Chris DeVony explains DOS's most neglected field of expertise: the disk masquerade commands. In the Utilities column veteran programmer Tom Kihlken presents his latest utility, *TRN2FILE.COM*, which frees you from the tyranny of applications programs by redirecting printer output to a disk file.

Mindful of the season, we bring you a bounty of good cheer in After Hours, where in head-to-head tests (er, in this case maybe nose-to-nose) we review the top four flight simulators. There's also a host of ideas for stocking stuffers, with reviews of everything from games to gorgeous graphics programs (one brings you "What's the night before Christmas" in words and pictures).

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- Hayes's *Smartcom III*
- *Inside Track II*
- *ABC Word*
- *dBUG III*, the first debugger for dBASE
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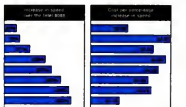
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Best of 86 review

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products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C.

Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the \$89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

Think Again.

DON'T TAKE OUR WORD FOR IT. USE EITHER BREAKTHRU 286 SPEEDUP BOARD FOR 60 DAYS. IF YOU ARE NOT TOTALLY SATISFIED SIMPLY RETURN IT FOR A FULL REFUND.

PCSG

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Everyone who tries it, tells us, "It's the best there is."

Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the \$199 list price, an introductory spread-the-word price of \$99.

Lucid 3-D is priced to sell at \$199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only \$99, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word

way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "Lucid 3-D is how software of the 1990's will look and perform", or even more to the point "This is the way I thought a computer should work". You'll see. Lucid is exciting.

way. Users say "It is so intuitive that I really don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recog-

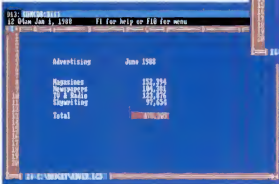


FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)



FIG. 1 Let's get the detail on those ad costs, just move the widebar to that cell and press one key (grey +).

What Makes it so Special

In the screen examples you can see Lucid is really

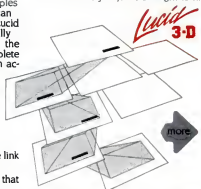
processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the

multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that

nize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.



Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write



FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any



FIG. 3 We want more detail, so let's go to Newspapers, just press the Grey + Key

“The best idea I’ve seen for a spreadsheet in years.”

Jim Seymour, Columnist, PC Magazine, PC Week



Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes. Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

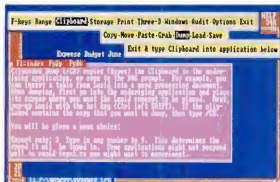


FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a master-



Makers of **LIGHTNING™**
disk speed up software, and
BREAKTHRU 286 Accelerator Board.

FIG. 7 Here it is right in Word Perfect (for any word processor) just like you typed it. You can go the other way just as easily.

work. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC Magazine, used one word to describe it, "Slick".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced **LIGHTNING** the pioneer and award winning Disk speed up software. In 1986 we developed the **BREAKTHRU 286** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "you have done it again. This is software everyone should have."



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Total	1,394,907

Get back to me as soon as possible.

Thanks,

James Johnson

C:\BUDGET\JOHNSON.JP

Doc 1 Pg 1 Ln 1 Pos 5

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

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CIRCLE 531 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE



DETAILS, DETAILS

I was absolutely astounded while reading the sidebar "Attention to Details" in your feature article on 386 computers ("Heavy Metal—386s Weigh In," *PC Magazine*, Volume 6 Number 16). Your praise for keyboards that connect to the front of the chassis certainly cannot be expressed by anyone who has anything but unlimited desk space. To fit the chassis and keyboard of our Compaq Deskpro on the same table, we have to push the rear of the chassis as close to the wall as possible, which strains all the cables coming out of the back of the machine. I'm sorry, but that is nothing but stupidity.

David M. Kretschmar
South Bend, Indiana

Regarding the "mysterious pair of feet on its top side" in your review of the PC Discount Noble 386 ("Heavy Metal—386s Weigh In"): A few months ago I transmitted a paper document to a vendor using a PC fax board. The vendor stated that everything came out fine except for one small hitch—I put the document in the fax machine upside-down and he had to stand on his head to read it on his screen. If only he had a Noble 386 he could have flipped "er over and brought his world back to normal!

Jeffrey B. Foster
Hopkinsville, Kentucky

We found the extra feet useful while trying to stand on our heads and do spreadsheets at the same time.

GREAT SOFTWARE, BUT...

I believe some reclassification of the programs Jim Seymour mentioned is in order ("What Qualifies as Great Software?", *PC Magazine*, Volume 6 Number 16).

Lotus's 1-2-3 has become an industry standard and now has some remarkable add-in programs like *HAL*. Yet it's copy protected. I'd say it's certainly great, but...

Javelin is a wonderful program at a reasonable price. The new version, *Javelin Plus*, is even better. However, *Javelin* still has not sold as many copies as its quality would suggest. I'd call it arguably great.

WordPerfect is my idea of a truly great program. It has technical excellence, superb support, and acceptance by a large and ever-growing number of users.

Martin S. Snitow
San Jose, California

Jim Seymour's review of *ACT!* ("What Qualifies as Great Software?") omitted both the name of the publisher and the price. There are at least two packages with the same name, so that information would be helpful to those readers who are trying to find the program.

Nick Feakins
San Mateo, California

Conductor Software of Irving, Texas, publishes ACT!, which is priced at \$395. For more information, contact the firm at (214) 929-4749. A review appeared in Volume 6 Number 16, page 48.

LIFE AFTER DOS

I agree with Charles Petzold that DOS is limited (Environments, *PC Magazine*, Volume 6 Number 16), but big deal—so is the solar system.

As one of your "nonprofessional programmers," I am sick and tired of having obsolescence forced down my throat, especially when it serves little else but to enrich the few. OS/2 is designed to obsolete all hardware and software based on DOS, and the cost of converting is extreme in money and time for both programmers and users. I refuse to play into IBM's hands!

John J. Williams
Alamogordo, New Mexico

PROJECT MANAGEMENT

I would like to thank Henry Fersko-Weiss for his article "Master Plans: Project Management Software" (*PC Magazine*, Volume 6 Number 16). As Mr. Fersko-Weiss puts it, "Choosing a project management program is a tricky business."

I understand that it is not possible to review all 100 or so project management programs on the market, but I was surprised by the absence of *Advanced Management Systems* by Diversified Information Services of Studio City, California. *AMS* is a very good, versatile, and powerful tool. It would have been interesting to see how this program compared with the other programs reviewed.

Ashok Apte
Houston, Texas

Much of what I read in your article on project management software was inconsistent with my own experience and with those of my clients ("Master Plans: Project Management Software"). Only a few of the programs evaluated are capable of



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- ☐ ORGANIZER 1—DentTeam, a Schedule clone,
and the Judy personal calendar program.
- ☐ PRINTER 1—Resident print control and fast
utility. Intelligent spooler, banner maker, and more
- ☐ SIMULATION 1—Maze making program, MIT's
Life simulation, interlards, etc. Color graphics req.
- ☐ UTILITIES 1—A collection of invaluable general
purpose DOS utilities. An absolute must for all
- ☐ UTILITIES 2—More invaluable DOS utilities in-
cluding screen burnout, ram disk, and more
- ☐ UTILITIES 3—A comprehensive set of debugging
and diagnostic utilities for monitoring your computer

NEW RELEASES UPDATES

- ☐ BUSINESS 2—Expressgraph business graphics
chart your data and find trends. Color graphics req
- ☐ CAD 1a,b—(2 disks) Fingerprint 1.2 advanced
pasting and Altairme object oriented design. Color
req
- ☐ CAD 2a,b—(2 disks) DarcCad, an advanced
2D/3D drawing program w/animation. 640K, color
req
- ☐ COMM 4a,b—(2 disks) Procomen 2.42, an excel-
lent modern program with terminal emulation
- ☐ EDUCATION 3—PC-Fasttype 1.20 typing tutor,
ideal for beginners and advanced students alike
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a powerful and user friendly spreadsheet program
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and Wheel of Fortune played on the gameshow
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ages! Excellent for demo, etc. Color required
- ☐ GRAPHICS 2a,b,c—(3 disks) An excellent 3-D
surface modelling and shading program. Color
req
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intecode prefix to zip-code cross reference
- ☐ LANGUAGE 3a,b—(2 disks) The 486 3.09
macro assembler and debugger for 5008/56-286s
- ☐ SHELL 4a,b—(2 disks) Autormenu and HOM 11
4.04 hard disk prog. for custom full-screen menus
- ☐ UTILITIES 5—Hard disk utilities for verifying,
formatting, partitioning and optimizing your disk
- ☐ UTILITIES 6—Advanced utilities including
Mark Release (remove resident prog w/o reboot)
- ☐ UTILITIES 7—More advanced utilities including
Masterkey (unlocks files from hard disks)
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port

Most software listed is shareware or user-supported
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CIRCLE 302 ON READER SERVICE CARD

VIEWPOINTS

LETTERS

scheduling project activities and monitor-
ing the progress for large projects. And a
number of the packages reviewed are so
deficient in these areas that it is question-
able how one could recommend them for
all but the most simple projects.

In addition, it seems the author has an
obvious bias against PERT charts as a tool
for building projects and tracking their
progress. The author loved *Time Line*,

Number 14) and RN.COM (Utilities, Vol-
ume 6 Number 16) are becoming so auto-
matic for me, they feel like extensions of
the brain.

Now I eagerly read Mr. Petzold's OS/2
articles and look forward to the future of
his new Environments column. Since I
can't see paying Microsoft three grand for
their seminar, I am hoping he can enlight-
en those of us with light pocketbooks.

John K. Patton
Dallas, Texas

Few programs, free or not, have ever delighted me as much as Michael J. Mefford's DR.COM.

which has an excellent Gantt chart module
but is incapable of producing a PERT
chart. At the same time, he seemed to
downgrade *SuperProject Plus* because of
its PERT chart orientation.

The article does provide useful infor-
mation if a knowledgeable reader takes time
to read through the biases and inconsisten-
cies. But I feel it is well below the stand-
ards of comparative evaluations that have
been published previously.

Robert A. Walker, Ph.D.
Falls Church, Virginia

UTILITY FEVER

As a committed PC zealot and consultant,
I use much of what comes out of the PC
Lab Notes and Programming columns.
Your utilities have become some of the
most useful and reliable available at any
price.

I particularly welcome Ray Duncan to
PC Magazine (Power Programming, *PC
Magazine*, Volume 6 Number 20). He is
joining excellent company with Messrs.
Petzold, Mefford, Prossie, Hummel, and
all the others who have provided some of
the finest utilities. I have learned much by
playing with Mr. Petzold's EGA utilities,
and Mr. Hummel's SPECTRUM (PC Lab
Notes, *PC Magazine*, Volume 6 Number
12) is a dream for EGA color fanatics.
Also, Mr. Mefford's DR.COM (Program-
ming/Utilities, *PC Magazine*, Volume 6

Few programs, free or not, have ever de-
lighted me as much as DR.COM (Pro-
gramming/Utilities). It serves its adver-
tised purpose in immensely simplifying
the task of sorting and cleaning up hard
disks. But far and away I derive the most
use and pleasure from its ability to plunge
directly into text files. DR.COM lets me
not only see what those files are, but read
them quickly. Farewell to "type
filename.ext I more."

Bruce Abell
Washington, D.C.

Congratulations to you and Michael J.
Mefford on RN.COM and DR.COM, two
of the most useful utilities in a long time at
any price (Programming/Utilities). The
provision of a page of instructions on
RN.COM suitable for inclusion in the
DOS manual was an excellent idea—I
hope you can prepare similar pages in fu-
ture issues.

John R. Hansen
Alexandria, Virginia

Your magazine keeps getting better and
better; I received my new PS/2 the week
after RN.COM appeared, and it was in-
valuable in setting up my hard disk (Utili-
ties). I also like your new format for pre-
senting the summary of a command's
operation.

Michael Trombetta
Manhasset, New York

INCONVENIENCE OUTWEIGHED

I wish to take exception to the sidebar by
Jim Seymour titled "Portable Printers:
Why Bother?" ("Portable Printers: Two
for the Road," *PC Magazine*, Volume 6
Number 16). For several years I have car-
ried my HP 110 along with my printer. As

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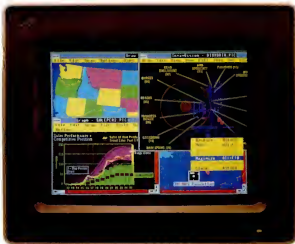
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Windows DRAW is a business drawing and presentation graphics program, which includes over 1000 predefined clip art images. Windows DRAW was rated as the number one free-form graphics program by Software Digest (Dec., 1986) and is sold internationally by Microsoft.

Windows GRAPH is a business graphics and charting program, and is the newest member of the Micrografx family. With Windows GRAPH, you can create an unlimited variety of area, bar, column, line, pie, scatter, combination, and table graphs. Use existing spreadsheet data or enter data directly to create a stunning array of two- and three-dimensional color graphics. Then enhance your charts with free-form drawings, multi-font text and clip art.

In*Vision is a powerful, easy-to-use Computer Aided Design (CAD) program. In*Vision was the first Windows-compatible program and according to PC Magazine (June, 1987), "In*Vision is still the best Windows-specific application." In*Vision is ideal for design professionals. Whether you are creating complex technical drawings, schematics, flowcharts, floor plans, organization charts or designing your own new kitchen, In*Vision makes your job easier.



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With Windows, each Micrografx application can run in a window simultaneously with any other Windows application. And Micrografx applications are data compatible with all other Windows applications through the Windows Clipboard. A common user-interface, pull-down menus, mouse support, shared device drivers and our common "object-oriented" file structure gives you consistent ease-of-use

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In addition, Micrografx offers Windows ClipArt with over 1000 business-oriented images and CAD ClipArt with over 1000 images from the architectural, electrical, chemical, and mechanical engineering fields. And through Windows CONVERT, your graphics are fully compatible with the AutoCAD data exchange format (DXF).

For additional information about how to put Micrografx to work for you, call your local authorized dealer, or contact Micrografx toll-free, at 800-272-DRAW (in Texas 214-234-1769) or write to Micrografx Inc., 1820 N. Greenville Ave., Richardson Texas 75081. Call today and let Micrografx take the dirty work out of doing Windows.

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Supports the new IBM PS/2 standard

■ LETTERS

a managing consultant traveling worldwide, I cannot depend on others to provide printing capability and must be self-sufficient.

The thought of standing around plugged into an airport's or a hotel's equipment versus the comfort of sitting in a client's office is impossible to contemplate. The combination of the 8-pound computer plus the ThinkJet printer (a total of 15 pounds) outweighs the inconvenience of using others' printer equipment. So please, don't sell carrying your own printer as an inconvenience.

Rodman C. Wilson
Saddle River, New Jersey

Dvorak and Junior

In John C. Dvorak's October 13 column, he reveals either some amazing new information on the PCjr or a dismal ignorance of his subject matter ("Seven Lessons IBM Learned from the PCjr," *PC Magazine*, Volume 6 Number 17). Where, I wonder, is that "extra disk drive out" port that he mentions? Some of those cryptically labeled holes on the back of the PCjr are mysteries, but to my knowledge, no one, until your Mr. Dvorak came along, ever figured out how to attach an external disk drive to one of them. IBM never sold an external drive for the PCjr, and existing third-party drives attach via various weird schemes.

James R. Stone
Washington, D.C.

I got carried away. Mr. Stone is correct: most add-on drives are connected through the internal modem connection.

—John C. Dvorak

Your October 13 issue was sensational—it was the most useful, fact-filled work yet. Too bad about the single egregious error: someone slipped in some words under John C. Dvorak's byline praising an IBM product ("Seven Lessons IBM Learned from the PCjr")! This just proves that only Allah is perfect.

Tom Holzel
Acton, Massachusetts

For John C. Dvorak to compare the PCjr to the PS/2 Model 25 is like comparing a Model T Ford to a 1987 model and saying

that Ford should have used many of the 1987 features in the Model T ("Seven Lessons IBM Learned from the PCjr"). I have gotten a lot of good use out of my PCjr, and disagree that it is a flimsy machine.

Robert H. Hellmann
Marysville, Ohio

The few years that exist between the announcement of the PCjr and the Model 25 hardly compare to the decades that passed from the time the Model T was built until 1987 . . . although it's possible that using a PCjr for any length of time may seem like an eternity.—John C. Dvorak

CORRECTIONS/AMPLIFICATIONS

The correct price of Ontrack Computer Systems' *Disk Manager* is \$124.95 and that of their *Disk Manager Diagnostics* is \$49.95 ("Rx for Slipped Disks," *PC Magazine*, Volume 6 Number 16).

Ventura Publisher and PageMaker can import *Halo DPE* graphics files ("PC Desktop Publishing Comes of Age," *PC Magazine*, Volume 6 Number 17).

The correct price of Door Openers' *Your Personal Poet* is \$29.95 (After Hours, *PC Magazine*, Volume 6 Number 17).

In the article "Scanners Take Off" (*PC Magazine*, Volume 6 Number 17), we inadvertently switched photographs for Princeton Graphic Systems' Laser Scanner Model LS-300 and The Laser Connection's TLC IS-300. The correct picture of the LS-300 is on page 276, and the IS-300 is pictured on page 292.

HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion to Letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or through MCI mail to PCMAGAZINE.

All letters become the property of *PC Magazine* and are subject to editing. We cannot publish letters that do not include a name, address, and phone number for verification. We're sorry we're not able to answer letters personally. ☐

What's New in Shareware...

Big-Cal creates a file containing a month's calendar for printing on one page (horizontally or vertically) or spread over two pages (which you tape together).

Big blocks for each day allow plenty of room for making plans. Small calendars for the preceding, current and following months are added for reference.

The file can be sent directly to the printer, or you can use your favorite word processor or editor to add any custom touches which your printer supports, such as wide or emphasized print, italics, etc.

EDraw 3.2 is a general purpose drawing program for engineers, teachers and students. It is ideal for schematics, block diagrams and flowcharts.

3x3 prints labels for 3.5" disks showing file names, disk name, size and free space and comments.

Library for Turbo-C has over 100 functions for use with Borland's Turbo-C (tm).

MyEd is a pop-up text editor that takes as little as 7k of RAM, yet has many features, such as optional wordwrap, paragraph reformat, auto-indent, unlimited file size, split/yon lines, block copy & delete, and source code too.

Name Pal is a name, address and phone number recording program that prints mailing labels, pocket-size address books, rolodex cards, 3x5 cards and full-page rosters.

Ticklex is an appointment scheduler and reminder program. Reminders warn you at preset times before an appointment.

Vehicle Maint. Exp. tells you when it's time for your car's regularly scheduled maintenance and even prints a checklist and keeps track of your auto expenses.

These programs are shareware, meaning that you can try them for our disk fee of \$5/disk and pay the author only if you decide to keep using the program. Registration fees range from \$5-\$40.

Find out more about unique, outstanding programs found only in shareware. Call or write for a FREE sample newsletter and complete library listing:

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PC BRAND ANSWERS THE MOST ASKED QUESTIONS ABOUT CLIPPER™

What Does The Clipper Compiler Do?

Clipper™ compiles dBase III™ and dBase III Plus™ source code programs, procedure and format files into a binary program which can be distributed and executed independent of dBASE.

How Much Faster Is Clipper?

Applications run anywhere from 2 to 20 times faster than the same application in dBase III or dBase III Plus. The average application typically runs 5 or 10 times faster.

How Compatible Is Clipper With dBase III and dBase III Plus?

Clipper supports the majority of dBase III commands except those that are normally used interactively. There are some minor differences in the implementation of some other commands.

DBF, FRM, MEM and LBL files are the same as interpretive dBase III. Clipper index files have the extension .NTX (corresponding to dBase .NDX) and result in faster indexing and more efficient use of disk space.

NEW VERSION: CLIPPER SUMMER '87

- compatible with Microsoft C
- NDX file compatibility option
- compile-time and run-time speed enhancements
- complete file I/O control
- more open files utilizing DOS 3.3
- error handling
- enhanced debugger
- added commands and functions
- purchasers of Autumn '86 version will receive a FREE diskette upgrade

Does Clipper Support Networking?

Yes. Both versions Autumn '86 and Summer '87 allow you to run compiled applications on most major networks. They feature record and file locking and support Expanded Memory.

A second work station may view or read a locked record or file and produce reports. However, an operator of the second station cannot update or write to a locked record or file.

Do I Need Any Kind of Runtime Module To Run A Clipper Compiled Program?

No. Clipper produces an object code module with the extension .OBJ. When the .OBJ file is linked (using PLINK86 which is included) a relocatable file with the extension .EXE is produced which can be run directly from DOS.

Do I Need Clipper For Every Program I Distribute?

No. You can compile and distribute as many programs as many times as you wish. Nantucket charges no runtime or royalty fees for distribution of your compiled applications.

Are There Royalties For Adding Work Stations?

No. Clipper places no limits on workstations. You may add as many workstations as your networking software will allow with no additional fees.

Does Clipper Handle Memo Fields?

Yes. Memo fields can be stored as string values, allowing them to be searched, concatenated and REPLACED. ASCII text files can be read into memofields and memofields can be read into ASCII text files.

What Size Are Clipper Compiled .EXE Files?

The minimum size Clipper file is about 120K. This overhead is a one time expense and is present in even the smallest program. DOS requires 30-40K of memory. In addition, Clipper requires 64K for its own purposes once loaded, which means that in a 256K machine you could load a program of about 160K into RAM. If you create a program that exceeds your computer's memory, you may create overlays to work around the problem.

What Are Overlays?

Overlays are portions of your application that will NOT reside in your computer's memory until executed. An area of memory is designated for overlays by the linker. You then specify which portions of your program are transferred in and out of that memory area.

In What Language Is Clipper Written?

Clipper is written in the C language with some assembly language routines.



dBase III and dBase III Plus are trademarks of Ashton-Tate.
Clipper is a trademark of Nantucket Corporation.
PLINK86 is a trademark of Phoenix Software.
Microsoft Windows is a trademark of Microsoft.

REAL PROGRAMMERS DON'T USE dBASE. DO THEY?

We're finding that some very swift programmers are using dBASE™ to write some very fast applications, and are completing their projects much more quickly. But they cheat.

They use the Clipper™ compiler to combine dBASE with C and assembler. With dBASE used like pseudo-code, they can then quickly create prototypes that actually run.

Then, with dBASE doing the high-level database functions, they use the Clipper compiler to link in C or assembly language modules from their own bag of tricks.

And they're finding that they're linking in less than they expected because Clipper compiled code runs so fast and because of Clipper's built-in enhancements.

- Easy networking that provides file and record locking the way it should be done
 - Fast screens that can be treated as memory variables and eliminate the need for direct screen writes and all that tortuous heap management code
 - Box commands that made windowing a breeze. And more.
- So if you'd like to use your time more productively, check Clipper out.

Does Clipper Allow You To Create Windows?

Yes. With Clipper's new SAVE SCREEN and RESTORE SCREEN commands windows can be created and manipulated.

Will Clipper Interface With Microsoft Windows™?

Clipper will run and compile with Microsoft Windows™ but will not run as a separate task.

Is Clipper Limited To 640K Of RAM?

No. Clipper employs the Lotus/Intel/Microsoft™ expanded memory protocol, allowing use of up to 1 megabyte of RAM.

What Hardware Is Required To Run Clipper?

Clipper runs on any IBM PC, XT, AT, 3270 or 100% compatible machine running DOS 2.0 or greater for single user applications. Networking applications run on most major networks supporting DOS 3.1 or higher.

Is Clipper Copy Protected?

No. Copy protection was removed with the release of the Autumn '86 version.

PC BRAND PRICE \$375

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PC BRAND: YOUR SOURCE FOR dBASE ENHANCEMENT TOOLS

QUICKCODE PLUS for dBASE

Industrial Strength dBASE Application Generator

Writing code takes time and time is money. QUICKCODE PLUS saves you both, with dozens of features you've never seen before in a dBASE code generator.

Consider the value of automatically generating the following code, bug free, in just minutes: Relational applications that read, display, and update a dozen or more databases simultaneously. "Real-time" calculations, performed on screen as the user enters each field. Forms up to 11 screens long, with the ability to pass data between screens. Computational formulas that automatically combine data from different databases. 9 Data types, 15 field types.

Generic LOOKUP and UPDATE functions are provided on the disk as dBASE source code, which you can add to your own dBASE library. All generated code is highly optimized, modular, commented, 100% compatible with Clipper and FoxBase+, and conforms to the programming standards recommended by experts like Tom Reilly and Adam Green. User manuals include extensive documentation of the generated code and in-



structions on how to permanently embed your own changes in the generated code. Truly the King of code generators.

	Let	PC Brand:
QUICKCODE PLUS	\$395	\$170
QUICKREPORT	\$295	\$170
QUICKENTRY	Call	Call

BRIEF/dBRIEF

The Power Environment for dBASE Programming

Many worthy utility products supply needs that dBASE's programming language doesn't—dBASE III, dBASE IV, and a host of others. Trouble is, you have

BRIEF's macro language, grabs hold of BRIEF and turns it into a complete dBASE III and III Plus programming domain. Using BRIEF's underlying shell, capabilities and its own interfaces, dBRIEF can run external utility libraries, plus dBASE itself, and link to the Clipper/TM, FoxBase+ TM and QuickC++ compilers. All with dBRIEF still loaded and running the show. It can do what BRIEF already does plus:

- Create a screen layout into dBASE code for interactive data entry
- Display dBASE file structures in windows, a great convenience alongside your program files
- Expand keystrokes into full dBASE statements
- Insert automatically for cleanup display
- Create databases, index files, invoke Ashton-Tee's dFORMATTM and dCONVERTM, draw lines and boxes
- Simply marvelous programming environment for writing and editing dBASE programs. PC Magazine, 7/89. Source code included!

Requires BRIEF 1.32 or later and 284K, 512K to run dBASE within dBRIEF, 640K and harddisk recommended. BRIEF/dBRIEF. Let \$275. Ours call

to use them separately, then combine their output into your dBASE program files.

No longer dBRIEF, written as

dBIC Identical dBASE III Plus Files Using C

dBASE is a series of C libraries from dLattice which creates, accesses and updates files identical to those of dBASE itself. So dBASE can read and update the files too!

What for? It means both C and dBASE applications can operate on the same data bases interchangeably. It means C programmers can interface with the big market of dBASE users out there, yet still step the dBASE language. It means dBASE applications can now be linked to the universe of C libraries and tools to add windows, graphics, statistical analysis, all the things dBASE cannot do. It means the speed and power of C to improve clients accustomed to dBASE. dBIC's functions parallel all dBASE's file handling commands, many decomposed

to permit direct data manipulation. Ten checks of data, index, and memo files may be open at once. It also completes an ISAM package that you can forget dBASE and use dBIC only for C programming.

Our versions of dBIC mirror file formats for dBASE II and III and now dBASE III Plus makes your programs network ready! as many stations as a network allows. Hands-off mode handles record and file locking and unlocking automatically. Clicks of functions give you direct lock/unlock control.

Supports all four memory models. Speedy compiler and dBASE version. For dBASE II, III Let \$290. Ours \$195. For dBASE III Plus Let \$390. Ours \$395.

Buy double and you get source too!

WALLSOFT'S THE UI PROGRAMMER

Code generator for dBASE

The UI Programmer was developed for professional dBASE programmers who have been frustrated in the past by code generators. Up until now, a serious dBASE programmer had to take whatever code a generator produced and modify it to their needs. With UI, the developer can generate exactly the dBASE code wanted.

UI (User Interface) has two main functions: the first is a powerful forms editor to create sophisticated screen and menu forms in a matter of minutes. The editor is completely menu-driven. It works on the "port-and-shoot" principle—just put the cursor where you want and tell UI what to put there.

UI's other, more important, main function is generating code for the forms

you've designed. Once you have a form the way you want it, you call up the "Generate" menu, and tell UI which menu plate you want to generate the code with. That's the key—each template tells UI to produce a different kind of dBASE program.

It's through these templates that you can program the way UI generates source code. You can use the templates that come with UI "as is" (there are about 25 of them), completely rewrite them, or write your own. So you don't lose control of design, like you do with other generators. You just let UI do the tedious work.

	Let	PC Brand:
UI DOCUMENTOR	\$295	\$244
dFLOW	\$149	\$124
DAT-PA	\$ 60	\$ 50

dBASE AT THE SPEED OF C

dBx Translates dBASE Applications to C

You dBASETM programmers know what an expressive and readable language dBASE is. It's a very comfortable development environment. But the price is decreased performance. Even compiled dBASE doesn't offer the speed that some users require these days. The kind of speed offered by software written in the C language. The answer is dBxTM. dBx translates dBASE to C. It offers you a major competitive advantage over the next dBASE programmer. Keep writing in dBASE. Take every application all the way to completion. Then use dBx to translate them top to bottom to C! Other advantages: C is portable, even on other operating systems like UNIX/XenixTM. To the Macintosh or Amiga. dBx gives your applications a passport to places dBASE cannot go.

Has its own file manager for single user, but also major C file managers—c-tree and dBC—for compatibility with dBASE files or multi-user support. We have everything you'll need, including good advice.

	Let	PC Brand:
dBx	\$ 350	\$ 295
with Library Source	\$ 550	\$ 449
with Full Source Code	\$1500	\$1252



OVERDRIVE Take the Dose out of DOS

If you are one of the millions of personal computer users who are frustrated by slow disk access, you need OVERDRIVE. Overdrive will make your disk-intensive programs such as databases run faster. How fast? It depends upon your particular circumstances, but 50% speed increases are not uncommon.

For example, a dBase III accounting program ran 50% faster and a large Concord 3 database whose SORT time was 80 minutes, ran the same sort under Overdrive in 13.

Overdrive is not a disk cache, an optimizer or a RAM disk. In fact, Over-

drive will run even faster on your RAM disk because Overdrive eliminates the DOS "thinking time," not the disk time. Overdrive hooks itself into DOS and replaces its old slow program code with modern, efficient, well-designed routines.

Overdrive adds handy directory utilities and improves the speed of DOS backup and copy functions remarkably. Runs transparently and takes up only 26K of RAM for hard disk around 1/2MB per Megabyte of total disk capacity.

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HALO	\$300	\$219
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HALO for Microsoft	\$595	\$434

GREENLEAF LIBRARIES

Functions

C source, assembler source, and binary libraries of 225 functions for many compilers. Emphasizes tight coding, groupings to maximize loading code which your application may never use. Manual's 250 pages help select functions, as do demos, bulletin board. A sampling, DOS extensions for file and device management. Screen-selected mode, page, monochrome or color, palette; cursor shape, positioning, clearing and scrolling, pixel get and set. Strugs efficient operations to add, delete, sort string pointers for top speed. Other graphics primitives, keyboard status, function key assignment, time/date, read registers, get memory size, peek and poke. Specify \$0770 + Compiler. Let \$185, Here \$139

Communications

Communicate from within your own C programs! Over 120 functions and demo programs in C and assembler source to set up interrupt-driven speech communications for up to 16 channels. Up to 9600 baud, ASCII or binary, any parity or word length, 8250 UARTs, RS-485 and Xmodem, Wake/Standby, etc. Goodbye separate communications software. Specify compiler. Let \$185, Here \$139

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Leave the Device Driving to GSS

For serious applications such as the tools that stick to the standards. But the less you know why GSS™ has emerged as the pre-eminent graphics toolmaker is that it has always conformed to ANSI standards. At the heart of the system is the CGI standard Development Toolkit. It has all language interfaces and device drivers for keyboards, mice, joysticks, tablets, printers, plotters, cameras. The drives quickly translate your applications from concern for device idiosyncrasy.

GSS Kernel™ conforms to ANSI's CGS 2b and has all its drivers and language bindings. Macro-level toolkits drive color, segment, transform, store and recreate an object. The Metafile Interpreter reads ANSI COM files with full CGI capability for recreation on various devices. Quality software? IBM thinks so. They sell GSS under their own label. Royalties. Needs 256K.

The AUTOMATED PROGRAMMER

Enter Mathematical Notation Directly

A programming system for numerical computation that enables a computer to recognize and process mathematical, engineering, and scientific specifications. Using the two-dimensional (2D) Test Editor, direct computational formulas directly using conventional mathematical notation (e.g., integral, automation, numerator-over-denominator division, matrix inverse, dot and vector products, etc.) and technical English. The description of the problem solution (program) is expressed at such a high level that it approaches the ideal of an executable specification, i.e., for many problems, the

specification is the program. A correct program can be achieved many times faster than by current programming methods. Verification and debugging are often reduced to proof reading—"if it looks good, it is good."

The Automatic Programmer translates 2D programs into a target language, permitting easy interfacing with existing program libraries. The currently available target languages are FORTRAN.

Computational results may be embedded in complex 2D text and graphic. IMACS® formats using attractively diverse (WYSIWYG) fonts.

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BTRIEVE B-tree File Manager Plus Add Ons

If networks are on your horizon, bring your finger on Btrieve to the online master for your C, Pascal, BASIC, and COBOL projects looks like a smart move. Reason? Novell bought Btrieve's creator.

Btrieve's function library takes complete charge of all file creation, indexing, reading, writing, insertion, deletion, space reclamation, forward and backward searching. Its balanced tree indexing scheme finds any key in a million in four or less accesses. Files may have up to 34 indexes, record length up to 4096 characters, variable length up to 64K; indexes up to 255 characters; files of 64K bytes.

Let \$245, Use \$145. New Version. Let \$395. Curs Only \$445. Ask and about Xtrieve for Btrieve file access, and Reason for any network writing. All three are versions for any network that supports the MS-DOS 3.1 file sharing function.

PANEL PLUS Screen

Favorite Has Library Source

There are no screen designs and data entry tools quite like Panel Plus. With it you design a screen under program control, use Panel as utility to "run" and test a field in field, then pass it to the data generator which delivers C source code to work with as you please. The code calls Panel Plus's function library, but now the library comes in source, so everything is portable and changeable.

Has every imaginable feature. A screen can have 1000 fields stacked 127 levels deep. Each field can be boxed, colored, multi-row, word-wrapped, scrolled four ways, linked to help messages, matched to a picture, validated after data entry—etc.—an exhaustive.

Options in graphics mode via interfaces of graphics products it supports. Handles EGA's 43 line screen. Adaptable to various keyboards, screens, operating systems. Most look with years of evolution. Let \$465, Here \$365.

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CGI Driver Toolkit	\$495	\$375
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Shipping & Handling: U.S. UPS Surface. \$4.95 each. Each order \$25.00. \$3.00 each add'l \$4.50. NY Fed. Express or Federal Express 12 Day Air. Fed. Express \$15.00 each add'l \$1.00. Fed. Express 1st add'l \$1.00. International. Charges vary by destination and carrier. \$10.00 per shipping container for export forms. Air parcel cost of your risk beyond collected insurable amount.

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We refund the purchase price of any product returned within 30 days in any form. Reasonable condition. You can even try out many programs before we deliver. Ask for a satisfaction guarantee. There's no satisfaction stopping your buying from PC Brand.

C-WORTHY INTERFACE LIBRARY

The C-Worthy™ Interface Library wraps an entire user interface around your application. Its full power can be summoned by only a few high-level calls. Sound imagination? A single function call can set up a complete text editor in a screen window. Recently acquired by System 5, over 800 pages of Documentation, Turbo and Quick C version and a complete Interface Library have been added.

High-level calls pop menus and scrollable dialog boxes into the screen, restoring the background when dismissed. A single function call can set up a complete text editor in a screen window. Recently acquired by System 5, over 800 pages of Documentation, Turbo and Quick C version and a complete Interface Library have been added.

Windowing facilities open portfolios of up to screen size for viewing virtual screens larger than the physical screen. Full context-sensitive help screen manager takes over these chores and error messages. Automatic routines attempt with pagable text windows explaining what to do next.

Novell found it "played a key role and accelerated development" in making its NetWare™ utilities easier for users. Interested? Call for it.

Ask for	Let	PC Brand
C-Worthy	\$195	\$145
With Forms Library	\$295	\$245

BASTOC BASIC INTO C

For a trifling price, BASTOC™ moves thousands of BASIC code over to C's a translator which takes in Microsoft Basic, translated BASIC and emits pure C for Microsoft or Lattice. Structures even convoluted BASIC code. Optimized to dramatically reduce execution time. Dynamic string allocation ends BASIC's cumbersome string handling. Huge worksheet. Let \$495, Use \$395.

POLYTRON VERSION CONTROL

Source Code Control for Any Language

PVCS allows programmers, project managers, librarians and system administrators to control the proliferation of revisions and versions of source code in software systems. Independent programmers, the leading software publishers and LAN companies, and hundreds of Fortune 1000 companies rely on PVCS to store and retrieve multiple revisions of text. It maintains a complete history of revisions as an "audit trail," generates status reports, and uses intelligent "difference detection" to minimize disk space for each new revision.

On Corporate and Personal PVCS simultaneous changes to a module are merged into a single new version. If changes conflict, the user is notified. "Locks" used to track changes are interchangeable between any PVCS product.

Corporate PVCS is for multiple programmers. It includes "branching" to maintain code when programs evolve on multiple paths. Personal PVCS offers most of the power and flexibility of corporate PVCS, but excludes multiple programmer features. Network PVCS is the Corporate version for LANs. File locking and security levels can be tailored to each project.

PolyMake: Still using a preprocessor? Make! Step up to PolyMake, the most powerful and powerful Make tool. Most flexible macros of any Make. Now integrated with PVCS and PolyLibrarian for faster performance and precise configuration management. Ask for

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Corporate PVCS	\$295	\$245
Network PVCS	\$445	\$345
PolyMake	\$149	\$109

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Phoenix

PFORCE: LET PHOENIX WRITE HALF YOUR PROGRAM

Phoenix has amassed legions of functions into the ultimate C library—over 400 routines which stand at the ready to slash your development schedule and bring in your job ahead of budget.

PforC™ offers everything from low-level functions for hardware access to complete in-tree database management. There are expected essentials like string manipulations, the compiler libraries for sort, time/date calculations, screen and field editing, but also four styles of menus (Lotus included), windowing, background linking, complete DOS interfaces, directory management, even interrupt-driven communications. That's for applications. Then there are whole sets of utilities for disk and library management, archiving and compilation.

Design emphasizes objects: Windows, databases, records and fields take the

form of structures established outside functions, so you have complete control to change them.

You can find such diversity in other libraries, but you'll need to buy several. And there are added benefits to using one large collection. Everything in one index, all under a common set of instructions. Besides, Phoenix thinks even function libraries should have tutorials, source code demos, quick reference, and on-line help. Our versions have pre-compiled libraries for all memory models of Latice, Microsoft, C86, Wizard and Aztec, and full source code to use with any other compiler. Also a function prototype file to allow PforC to keep your calls precise.

This is Phoenix quality, which means a PforC to reckon with. List \$395 PC Brand \$225 **SPECIAL \$235**

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CIRCLE 310 ON READER SERVICE CARD

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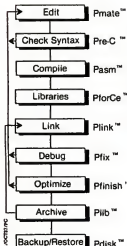
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■ MITT JONES

PC ADVISOR

Help in dressing up 1-2-3 tables, in adding memory to a PS/2 Model 50, and in finding communications software for the PC Convertible.

**SPRUCING UP SPREADSHEETS**

I've been a 1-2-3 user for some time now, and I find it hard to do much without it. However, I do have one complaint. I can draw boxes around my tables on the screen to dress up my worksheets using high-order characters, but 1-2-3 won't print the high-order characters. I end up printing my tables with dashes instead of solid lines, which is not acceptable for formal reports. Is there any way around this?

J. Floyd Lueck
Denver, Colorado

The most obvious solution is to print the table to a printer file and then import that file into a program that can do the job. Some word processors, such as WordPerfect, Version 4.2, have excellent line-drawing features that you can use to generate a presentation-quality table.

However, there is a package that not only lets you embed any high-order character into your 1-2-3 worksheets but that also lets you print them, provided your printer supports the IBM Extended Character Set. Tactecs (\$39; Royall Enterprises, Bloomfield Hills, Mich.; (313) 641-7799) won't bowl you over with finesse, but it's fairly easy to use and gets the job done. Tactecs is compatible with 1-2-3, Releases 2.0 and 2.01, and Symphony, Releases 1.0, 1.1, and 1.2.

As a final note, Lotus is expected to publish Release 3.0 of 1-2-3 in the not-too-distant future. One can never be sure, but Release 3.0 may include more-sophisticated line-drawing features than earlier versions.

PS/2 MEMORY UPGRADE

I am considering buying a PS/2 Model 50. The specs say this model has three expansion slots and can only be expanded to 7 megabytes. This implies 2 megs per board (1-meg system memory board plus 2 megs per slot). Does anybody make a board that will give me more than 2 megs in one slot, or has IBM made that impossible?

Robert Townsend
Framingham, Massachusetts

Your appraisal of the memory-expansion possibilities runs true to the specifications IBM published. While Models 50 and 60 can address 16 megabytes of extended memory, IBM publications state that the maximum amount of memory that physically can be added to the Model 50 is 6 megabytes—2 megabytes per slot.

As it turns out, this limitation exists only if you stick to IBM memory expansion boards, which, at least at the moment, of-

fer only 2 megabytes per board. Several third-party suppliers have already announced boards that exceed 2 megabytes, and at least one such board is already shipping—AST Research's Advantage/2 (Irvine, Calif.; (714) 863-1333). The Advantage/2 packs up to 8 megabytes of 120-nanosecond DRAM on one board, and it operated flawlessly, fully loaded, during PC Labs tests.

By the time this issue hits the newsstands, several other manufacturers—including Everex, Quadram, Newer Technology, and Cumulus Corp.—should be shipping 4- and 8-megabyte boards as well. Keep an eye on First Looks for reviews of these boards as we get them.

CONVERTIBLE COMMUNICATIONS

I would like to know if there is any software that will work with the IBM PC Convertible internal modem, which—thanks to IBM—is not Hayes compatible. I have tried several communications packages, to no avail.

R. Grant Tate
Bridgewater, Connecticut

■ This limitation exists only if you stick to IBM memory expansion boards, which, at least at the moment, offer only 2 megabytes per board.

First, I should point out that IBM has now swallowed its ego, if only temporarily, and conformed with the Hayes standard with the latest Convertible internal modem. You are among the unfortunate many who bought the Convertible when the only modem available used an IBM command set. IBM is offering no upgrade policy to the buyers of the ill-fated original, but you can pay full price, \$450, for the new Hayes-compatible version (part no. 81X8469).

■ PC ADVISOR

If you'd rather fight than switch, which translates to "if you'd rather not spend the money," you've got numerous options. First, IBM offers its Asynchronous Communications Support, Version 2.0. Call your IBM dealer for more information.

You'll also find that many popular communications packages meant primarily for Hayes-compatible modems support the IBM command set. Of the five communications packages that earned the Editor's Choice in our October 28, 1986, issue ("Asynchronous Communications: Shopping for Software," PC Magazine, Volume 5 Number 18), three directly support the PC Convertible modem—Hyper Access (\$149; Hilgraeve Inc., Monroe, Mich.; (313) 243-0576), PC-Talk IV (\$35; The Headlands Press, Tiburon, Calif.; (415) 435-0770), and Relay Gold (\$250; VM Personal Computing, Danbury, Conn.; (203) 798-3800).

However, even with these packages it's

not immediately obvious how to persuade the program to send the correct commands to the modem. Whichever communications package you own, try culling the company's technical support to inquire about

■ You may well find that your package includes undocumented support of the Convertible modem.

IBM command-set support. You may well find that your package includes undocumented support of the Convertible modem, or that the company will send you a script file or modified program file that will provide support.

MORE FOR THE PEANUT

Last issue I listed several sources of product information, and moral support, for users of the now-defunct PCjr. In addition to the sources I mentioned, two newsletters cater to PCjr die-hards: the jr Newsletter (P.O. Box 163, Southbury, CT 06488) and The Junior Report (P.O. Box 59067, Schaumburg, IL 60159-0067). Each is published monthly and can be had for an annual subscription fee of \$18.

Both include how-to articles, patches that enable popular programs to run on the PCjr, news about new software and hardware for the PCjr, and a question-and-answer column. The jr Newsletter runs from 12 to 20 pages a month. The Junior Report comprises 28 pages.

ASK THE ADVISOR

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C Programmer's Dream Screen Machine

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- ☐ **Easy:** C-scape is a powerful, but easy to learn, easy to use, easy to maintain, and easy to maintain.
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- ☐ **24-hour bulletin board:** Great for support and up-to-date information.
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* Borland option may upgrade to complete source and support for only \$180.00. Complete package including source available for Lattice, Microsoft, and other leading compilers for \$279.00. Add \$4.50 for shipping in North America, \$16.00 overseas. Price subject to change.

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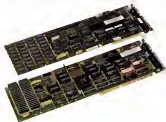
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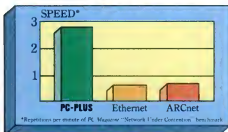
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CIRCLE 345 ON READER SERVICE CARD



“Memo to Phil in DP: Have we lost our minds?”

Our friends on the 6th floor want to get their hands on '386' PCs as soon as possible. And I agree. My question is — why do we automatically assume that means IBM? Now, we have a choice. I suggest you look at AT&T. The AT&T 6386 works with the PCs we already have, and we can run the same programs we're running now as well as those we'll run tomorrow. The issue here isn't just computers and software. But, it's keeping our options open. Now and down the road. And we know that AT&T is on our side in the long run.*

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Windows/386

(continued from page 33)

space required by ordinary DOS to service the programs. The rest of the *Windows/386* code runs in extended memory, invisible to your applications.

The other supposed strengths of Microsoft's *Windows* series are still not apparent in this 386 incarnation. *Windows/386* shares an enhanced *Windows* interface with the newly released *Windows*, Version 2.0, that brings some small but needed improvements such as menus that stay pulled down when you call them.

Although the words Presentation Manager in small letters on the *Windows/386* package hint at a link with OS/2, the connection is only superficial. *Windows/386* only looks the way the OS/2 Presentation Manager is supposed to, sharing the same overlapping (as opposed to tiled) windowing interface used by *Windows* 2.0 and promised for the new OS/2 version.

But appearances aside, applications written under the OS/2 Presentation Manager standard won't work under *Win-*

dows/386. The OS/2 Presentation Manager uses different underlying function calls and other features that programmers will have to contend with.

Windows/386 is not a forward link to OS/2 software but a backward connection that extends the possibilities of DOS programs. It runs both *Windows* applications (such as *Microsoft Excel* and *Micrografix's In-a-Vision*) and normal DOS programs flawlessly, either in a full-screen display, in smaller-size windows, or as icons.

To help get you started, *Windows/386* continues in the footsteps of its forebears by offering a handful of get-started applications, including a desktop management package based on *Notepad*, a text-only editor; *Cardfile*, a simple database; *Calendar*, an appointment system; *Calculator*, an electronic calculating machine; *Clock*, an analog clock; *Terminal*, a communications program; and *Reverse*, the well-known game.

To manage the output of several programs running at once, the *Windows/386* package contains a disk-based print spooler. Communication between tasks

is aided by a simple cut-and-paste utility.

Once you've set up a multitasking system, you can pop between applications with a couple of keystrokes. *Windows/386* also supports a mouse but does not automatically endow programs not so designed with the same ability.

Windows/386 also fails to fulfill the promise of its easy-to-use pull-down menu interface. Some commands require odd keystroke combinations that are difficult on IBM's 101-key Enhanced Keyboard (Alt-Tab, for instance).

Worse, you're required to learn a new jargon. The hundreds of pages of instructions you must understand to master *Windows/386* are just as daunting as those for DOS. You're challenged to create and modify files to set up each of your applications and *Windows/386* itself should you want to coax optimal operation out of your system.

In a way, that's all right. This is a product for power users, not PC pussyfooters. *Windows/386* will help you take advantage of the power of the 80386 and make your computer

PC FACT FILE

Microsoft Windows/386

Microsoft Corp.
16011 NE 36th Way
Box 97017

Redmond, WA 98073
(206) 882-8080

List Price: \$199

Requires: 1 megabyte RAM, 2 megabytes of hard disk space; 80386-based computer (separate version of program for IBM PS/2 Model 80); high-density floppy disk drive; *Windows*-compatible graphics adapter; DOS 3.1, 3.2, or 3.3

In Short: A graphics-based multitasking system for 80386-based PCs that allows simultaneous operation of both *Microsoft Windows* and DOS programs. Not copy protected

CIRCLE 439 ON READER SERVICE CARD

work more the way you want it to. With a basketful of applications open at once, you can make your PC screen as messy as your desk.

Ultrasync

(continued from page 33)

The maximum display resolution is 800 by 600 pixels.

The *Ultrasync* also boasts automatic-vertical-sizing circuitry, a feature the original

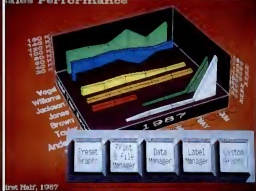


MultiSync lacks. Automatic-vertical-sizing circuitry adjusts the deflection circuitry automatically to keep the vertical size of the display constant when switching from one mode to another. NEC is introducing the *MultiSync Plus* in order to offer

Sales Performance



Sales Performance



The Princeton *Ultrasync* (left) and the Zenith *Perfect Monitor*, each driven by a PS/2 Model 60, display a Boeing *Graph* image. The *Ultrasync* display is sharper than that of the IBM 8513 PS/2 monitor (not shown), but the *Ultrasync* can't compete with the color saturation and contrast of the Zenith *Perfect Monitor's* flat tension mask screen

IBM VGA Adapter Card: 256K Video RAM, 17 Display Modes



HANDS ON

BY WINN L. ROSCH

The new line of IBM PS/2s is stylish, but it's most striking when you look at its video displays. The new graphics standard, called VGA (Video Graphics Array), gives the PS/2 Models 50 and above the sharpest, most colorful images yet available under an IBM standard. Although IBM Corp. said it would sell this board in July, the first production models began shipping in October.

With the \$595 IBM PS/2 Display Adapter, you can coax the same images from your PC, XT, AT, or PS/2 Models 25 or 30. Among its 17 modes, the VGA standard delivers graphics resolution of up to 640 by 480 pixels in 16 colors or 256 simultaneous on-screen hues chosen from a palette of 262,144 with a

dot density of 320 by 200.

In a growing field of VGA contenders, the PS/2 Display Adapter is the only product that can claim complete BIOS and register-level (hardware) compatibility with the IBM standard. The explanation is obvious—the PS/2 Display Adapter card is based on the same proprietary IBM VLSI chip used in the display systems of the higher-end PS/2s.

The IBM wonder chip is complemented by 256K bytes of video RAM and an INMOS DAC (digital-to-analog converter) chip. Two headers and an edge connector at the top of the card allow for future expansion.

The PS/2 Display Adapter supports all 17 VGA modes. Although many of these are software and hardware compatible with the earlier IBM monochrome, color graphics, and en-

hanced graphics standards, the card works only with certain multisync monitors or an analog monitor. Also, it is compatible only with analog-input monitors capable of handling the 31.5-kHz horizontal and 70-Hz vertical frequencies.

Although the many multisync-style monitors work with the PS/2 Display Adapter, they require an adapter cable in order to match the card's 15-pin connector to the 9-pin connectors of most displays.

IBM notes three differences between the PS/2 Display Adapter and the similar systems built into the PS/2: different implementation of the enable/disable register, a hardware interrupt, and BIOS flag support.

In testing, these differences had no observable effect. In an AT-level computer, the PS/2 Display Adapter generated images visually identical to those



FACT FILE

IBM PS/2 Display Adapter
IBM Corp.

Contact your local authorized
IBM dealer

(800) 447-4700

List Price: \$595

Requires: Analog or multisync
display.

In Short: The only display
adapter for PCs that has complete
hardware compatibility
with the VGA standard.

CIRCLE 441 ON READER SERVICE CARD

made by the internal display system of a Model 60.

Tests showed, however, the speed in an AT system is much slower than that of the VGA in a Model 60. BIOS control required three times as long; direct hardware writes took about 50 percent longer.

IBM's new PS/2 line may offer too many incompatibilities to make sense in your office, but the PS/2 Display Adapter is a winner from every angle.



FACT FILE

Princeton Ultrasync
Princeton Graphic Systems
601 Ewing St., Bldg. A
Princeton, NJ 08540
(800) 221-1490
(609) 683-1660

List Price: \$795

In Short: A digital analog
multiscanning monitor that
includes vertical as well as
horizontal automatic sizing for
the VGA display modes.

CIRCLE 446 ON READER SERVICE CARD

complete VGA compatibility.

So how does the Ultrasync stack up against the competition?

In digital mode, the Ultrasync has the edge in brightness and sharpness of image over the MultiSync, making its text easier to read. However, the colors on our evaluation unit were dis-

appointing. The dark gray appeared too greenish, the white too grayish, and the light gray too whitish.

The Ultrasync wins over the MultiSync in analog mode because of its automatic vertical sizing. The MultiSync display shrinks and expands drastically at times when shifting in and out of VGA modes. But the Ultrasync display remains constant through mode shifts.

Oddly enough, the Ultrasync loses its edge in brightness over the MultiSync in analog mode, but it also matches the MultiSync's near-IBM colors.

Compared with IBM's 8513, the Ultrasync fared well. Though the IBM always seems to keep the edge in trueness of colors, the Ultrasync's sharp display topped the fuzzy 8513 display hands down.

The prize for all-around picture quality in an analog monitor still goes to the Zenith Perfect Monitor with its 14-inch flat tension mask screen and

\$999 price. But if you want a digital/analog multiscanning monitor, the Ultrasync is an attractive choice. The picture

quality is above average overall, and you won't find another monitor that adjusts so well to a large range of scan rates.

Automatic-Vertical-Sizing Circuitry Is An Essential Feature for VGA Monitors

Most multiscanning monitors on the market, including the NEC MultiSync, lack the circuitry to keep VGA display sizes constant. Why, you ask?

With any display adapter/monitor combination, the distance between scan lines on the screen must be adjusted when the number of scan lines changes—if the screen is to remain the same size, that is.

Earlier display adapters, such as the EGA, depend on changes in the horizontal scan rate to allow large changes in the number of scan lines. Monitors such as the MultiSync adjust the distance between the scan lines by keying on fluctua-

tions in the horizontal scan rate.

The IBM VGA takes a different approach, holding the horizontal scan rate constant but varying the screen refresh rate (between 60 and 70 Hz). So monitors need some other way of automatically adjusting the vertical size of the screen.

IBM provided such a way in the VGA by signifying different line counts with different combinations of the horizontal and vertical scan signal polarities. Monitors such as the Princeton Ultrasync and NEC's new MultiSync models include the circuitry to adjust the screen size based on these signals.

—Mitt Jones

PFS:First Choice 2 Adds Mouse Support, Graphing, Thesaurus

PC HANDS ON

BY CHRISTOPHER BARR

Out of the box, *PFS:First Choice* was a bit. And why not? It's cheap, easy to use, and has everything a beginner could wish for in one package: a word processor, a database manager, a spreadsheet, and simple communications. But *Microsoft Works*, which was also released this fall, has its eye on the same audience, so Software Publishing Corp. is trying to stay one step ahead with *PFS:First Choice*, Version 2.

First Choice now boasts graphs, a thesaurus, mouse support, and a considerably different spreadsheet with 1-2-3 .WKS importing and exporting. The database and communications were fine as they stood and remain unchanged.

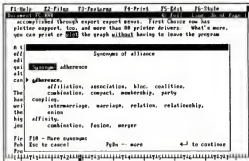
The graphs are first-rate, and you can choose from more than ten types, including bar/line charts and two pie charts side by

side. You can create a graph from an input form or draw it from a spreadsheet file. Customizing and editing are easily accomplished through the pull-down menus. *First Choice* now has plotter support, too, and more than 80 printer drivers.

A thesaurus has been added to the word processor, and using it is as effortless as invoking the spelling checker. It's no puny

of an editor, either—*First Choice*'s word processor is full-featured and fast. You can place a graph into a document for printing, although you won't see it displayed on-screen.

The spreadsheet was the Achilles' heel of the original release, and it's been improved with a bit more speed, the ability to read and write to a .WKS file, and a copy command that



PFS:First Choice 2's thesaurus pops up over your word processing document.

PC FACT FILE

PFS:First Choice, Version 2

Software Publishing Corp.
1901 Landings Dr.
P.O. Box 7210
Mountain View, CA 94039
(415) 962-8910
List Price: \$149; upgrade from Version 1, \$49.95.
Requires: 512K RAM, DOS 2.0 or later.

In Short: A good and easy beginner's package gets even better. Not copy protected.

CIRCLE 434 ON READER SERVICE CARD

lets you copy to a range, instead of just to a single cell. It's not completely compatible with 1-2-3, and there's still no macro capability.

Like the entire Software Publishing line of products, *PFS:First Choice* has top-notch documentation. But *First Choice* is so easy to use, you might not need it. The folks at Microsoft are going to have to work overtime if they want to displace *First Choice* as the top-selling beginner's package. ☐

Smartcom III: Is it Too Little, Too Late?

PC HANDS ON

BY HOWARD MARKS

Hayes Microcomputer Products' *Smartcom* has always been an anomaly in the communications software market. Even though it had a huge installed base, no one could call it a technology leader. Still, it got the job done, and there are thousands of happy *Smartcom II* users in the field.

Hayes's latest, *Smartcom III*, is a totally new package, sharing only its name and distribution methods with its younger brother. *Smartcom III* is a fully fleshed-out communications program with a full-screen editor, a powerful script language called Scope, keyboard macros, context-sensitive help, and the ability to run multiple sessions

simultaneously. Like many of its peers, *Smartcom* has a learn mode that will build a script to log in to your favorite information service by remembering your keystrokes as you log in manually. There is also a translator to convert *Smartcom II* macros into *Smartcom III* scripts.

Smartcom III is a big program requiring 512K bytes of main memory and about a megabyte of disk space. It's also very picky about modems; it works only with genuine Hayes and certain compatible modems. The modem control strings are not programmable, and it will not work with many modems that are sold as Hayes compatible. For example, I could not get it to work with a U.S. Robotics Courier HST or a Kyocera modem.

Smartcom III supports Kermit and Xmodem file transfer protocols, including Xmodem-CRC, Ymodem, and Ymodem-G variants. The Ymodem-G protocol is frequently used with error-correcting modems such as Hayes's own V-Series. Curiously missing are the Hayes file transfer protocol that was included in *Smartcom II* and any form of Sliding Windows protocol for use on packet-switching networks such as Telenet or Tymnet. *Smartcom II* users will have to use Xmodem to transfer data to *Smartcom III*.

Smartcom III is a powerful and simple-to-use package. Unfortunately, it takes up a huge amount of disk space and enough memory to make you give up some of your TSR programs. This, combined with its insistence on genuine Hayes

PC FACT FILE

Smartcom III

Hayes Microcomputer Products Inc.
705 Wesch Dr.
Norcross, GA 30092
(404) 441-1617
List Price: \$249
Requires: 512K RAM, two disk drives, DOS 2.1 or later.
In Short: A sophisticated communications package from the leading modem maker. Works only with 100-percent Hayes-compatible modems and requires extraordinary amounts of both RAM and disk space. Not copy protected.

CIRCLE 435 ON READER SERVICE CARD

modems, puts *Smartcom III* on the "Not Recommended" list. ☐

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Inside Track II: A Streamlined Information Manager for \$100

PC HANDS ON

BY DONALD B. TRIVETTE

Information-tracking software is the newest twist in database management. It differs from general-purpose DBMS programs like *dBASE III* and *Q&A* by using fixed fields and a structured record format. *ACT!*, from Conductor Software, is one example (see *First Looks*, page 48, *PC Magazine*, Volume 6 Number 16), and now *Inside Track II*, from I-Track Corp., is another.

Inside Track has two formats: one to record and display information on individuals and the other to track organizations. Both have fields for name, address, city, three telephone numbers, and notes. The organization format includes places to record contacts, titles, category rankings, and a variety of financial items; the individual format uses those fields for sec-

retary, spouse, children, and birth and anniversary dates. Although the number and size of fields are predefined, the number of records is limited only by the size of your disk.

The F8 key toggles between formats, and the other function keys control finding, editing, and reviewing records. The Alt key is used with other keys to

switch from one database to another, query the file, print records, and even address envelopes.

Inside Track can be used to keep tabs on job applicants, manage lists of clients, or record product registrations. I-Track also sells prerecorded databases—including guides for 35 major cities, Fortune 500



You do not have to tell *Inside Track II* about names, telephone numbers, ZIP codes, cities, or streets; all fields are predetermined.

PC FACT FILE

Inside Track II, Version 1.03

I-Track Corp.

710 E. Park Blvd., #204

Plano, TX 75074

(800) 843-3879

(214) 578-1014

List Price: \$99.95; \$39.95 for individual databases.

Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: An information manager with predefined fields, designed to track individual and corporate directory information. Memory resident and easy to use; lacks a telephone dialer. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

companies, and sports (golf, tennis, skiing, and college and pro football)—all of which you can modify.

Inside Track's most serious flaw is its lack of a telephone dialer, which the company says it will remedy with the next version.

ABC Word Utility Has All the Makings Of a Good Memory-Resident Dictionary

PC HANDS ON

BY JARED TAYLOR

ABC Word, from Automated Language Processing Systems, is the kind of program I dreamed about when I first bought a PC: an on-line reference you can consult right from the keyboard. It's convenient and easy to use; its only trouble is that the dictionary is a lightweight.

When you run *ABC Word*, you can call it up any time to check words in the document you're working on. It acts as a dictionary or thesaurus, depending on your last query, and you can switch easily between the two. In either mode, searches are reasonably fast on an AT.

In dictionary mode, *ABC*

doubles as a spelling checker: if it doesn't find a match, it proposes near-misses. If it finds a match, it gives you a workable but very stripped-down definition. It shows hyphenation points but gives no etymologies or pronunciation symbols.

These limitations would be acceptable if the dictionary were larger. Unusual words—the ones you really need a dictionary for—are not there. I couldn't find *Precambrian*, *hajj*, or *defenestrate*. Also, there are strange inconsistencies. The dictionary knew of *Cherokees* and *Seminoles* but not of *Mohawks* or *Sinox*.

There are also very few multiple-word entries. There's an entry for *sulfuric* but not for *sulfuric acid*. There's a definition

for *such a one* (whatever that is) but not *such and such*.

ABC Word's thesaurus is better. I couldn't find any obvious, gaping holes. However, thesauri are easier to code and are less useful than dictionaries—and I have one already.

ABC Word is essentially a fast lookup engine. You can write your own dictionary-type databases, which the program will index and search. If you have boilerplate text in your dictionary, you can copy and paste it directly into another document. You could build your own foreign-language dictionaries, but ALP Systems saves you the trouble. It sells separate modules for English-to-French, -German, or -Italian.

But what I really want is a

PC FACT FILE

ABC Word, Version 1.0

Automated Language

Processing Systems

190 W. 800 North

Provo, UT 84604

(801) 379-2300

List Price: \$150; each additional bilingual dictionary, \$50.

Requires: 512K RAM, hard disk drive, DOS 2.1 or later.

In Short: An on-line dictionary and thesaurus that can run either as an application or as a TSR (terminate-and-stay-resident) program. Foreign-language dictionaries are available, and you can make your own lists of references. Not copy protected.

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serious English dictionary, and I don't have time to build my own.

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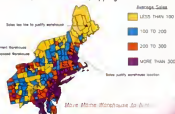
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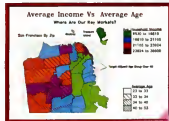
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At Last: A Debugger for dBASE

PC HANDS ON

BY PETER LOSHIN

dBASE III, from HJS Research, faces up to one of the dirty little secrets of **dBASE III** programming: you need a real debugger to write anything useful. **dBUG III** is the first source-level debugger for **dBASE III**—you can use it to monitor field and memory variables, observe program execution one step at a time, and execute smaller sections of code with breakpoints.

dBASE programmers get by with **dBASE III**'s debugging options; some programmers write special code that displays the section of code being executed and variable values during debugging. Programs like *Documator* are used for finding syntax errors like open loops.

dBUG III gives you control over execution and lets you easily check variable values by scanning your programs and creating intermediate (.DBG) programs with instructions for the debugger. These files are

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PC HANDS ON

BY DONALD B. TRIVETTE

There are 16 million companies in the United States, and 750,000 are found in Dun's Financial Records, the newest addition to the Dow Jones News/Retrieval on-line service. The reports contain both financial and profile information on a variety of retail, wholesale, service, and industrial companies. Large, medium, and small, public, closely held, and private, the companies range from public giants like AT&T to tiny private firms like Star Leasing in Fayetteville, N.C.

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If you are not certain of the full company name, you can still find it among the 750,000 companies that are listed in Dun's Financial Records.

base, you can search for a particular company in one of three ways: by DUNS number, by

telephone number, or by full or partial company name. This last option makes the service valu-

able to those who need information about a company but don't know its full name. Once you find the firm, two reports are available: profile and financial.

The profile information covers items like company name, number of employees, nature of ownership, and limited financial data such as net worth. The financial report has in-depth balance sheets, profit-and-loss items, comparisons with past financial statements, and ratios that measure profitability.

List Price: Dun's Financial Records, \$37 for profile report; \$69 for financial records; \$85 for both. **Requires:** Modem, Dow Jones News/Retrieval account. Dow Jones News/Retrieval, P.O. Box 300, Princeton, NJ 08540; (609) 452-1511.

CIRCLE 436 ON READER SERVICE CARD

Bringing EMS 3.2 to Any Memory Board

PC HANDS ON

BY EDWARD MENDELSON

If you have two floppy disk drives and an abacus installed in your PC, you won't be able to use *SoftBytes* to simulate expanded memory. Almost any other configuration will be fine.

Expanded memory normally works only with expansion boards designed to implement

the Lotus/Intel/Microsoft expanded memory specification (LIM EMS). *SoftBytes* simulates EMS (Version 3.2, not 4.0) in any PC that has a hard disk or the extended memory that comes with ATs and PS/2 machines. If you need expanded memory for large spreadsheets or programs like *WordPerfect Library* that swap programs in and out of expanded memory and DOS memory, *SoftBytes*

can save the expense of a memory board. It also works on laptops that won't accept an EMS board but have a hard disk or large RAMdisk.

The manual lists an imposing array of options, but the menu-driven installation guides you toward the right choices for any standard configuration.

SoftBytes is speediest when used with extended memory in 80286 machines. It's almost as

fast with a RAMdisk. It will work with a hard disk, but so slowly that you'll have time to order a memory board while it installs itself. Special EMS emulators like Quarterdeck's *QEMM-386* are required for 80386 machines.

List Price: *SoftBytes*, Version 2.0, \$49.95. **Requires:** One disk drive, DOS 2.0 or later. Not copy protected. Vericom, 8825 Aero Dr., #210, San Diego, CA 92123; (619) 277-0400.

CIRCLE 437 ON READER SERVICE CARD

RAM Lord Manages TSR Programs in EMS Memory

PC HANDS ON

BY EDWARD MENDELSON

RAM Lord is the pop-up manager for pop-up maniacs. This \$99.95 utility from Waterworks Software stores up to 20 TSR (terminate-and-stay-resident) programs in expanded or extended memory and pops them

into action at the press of a "hot key." You can keep a megabyte or two of TSRs under *RAM Lord*'s watchful eye without sacrificing all your DOS memory. *RAM Lord* uses the space needed by the largest of your TSRs plus 25K bytes for itself.

When you invoke a TSR it jumps out of extended or expanded memory (under LIM

EMS 3.0) into *RAM Lord*'s area of DOS and remains there until you call another TSR to take its place. In systems with 640K or less, *RAM Lord* can't save any memory, but it can stop memory wars by enabling different programs in turn.

TSRs are the least manageable of all programs, and *RAM Lord* can't always control them. The selection menu tends to pop up when it isn't needed. Pressing a hot key sometimes gets results a few keystrokes later. And with some combinations of TSRs, *RAM Lord* will lock

up sooner rather than later.

RAM Lord can't control TSRs like caches and spoolers that always remain active. Still, if you want to keep several large pop-ups constantly ready to pop, *RAM Lord* may be your best chance to keep them from jamming your RAM.

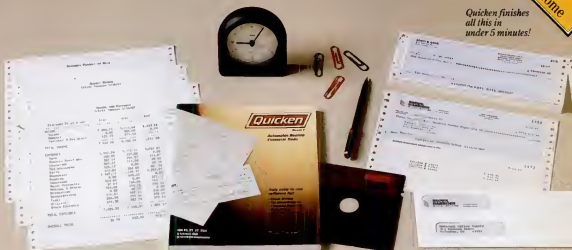
List Price: *RAM Lord*, \$99.95. **Requires:** One disk drive, DOS 2.0 or later. Not copy protected. Waterworks Software, 913 Electric Ave., San Benito, CA 90740; (214) 594-4768.

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"Absolutely the best small accounting program made."

Bob Schenck, *Universal Press Syndicate*

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CIRCLE 151 ON READER SERVICE CARD

Expert Systems Now Simplified: \$495 PC Easy Manages Details

PC HANDS ON

BY WILLIAM TAYLOR

The creation of an expert system involves writing questions that elicit information from users and writing rules that draw the right conclusions from this information. *Personal Consultant Easy*, from Texas Instruments, simplifies both sides of this job with a set of interface routines that present questions and with a rule editor that lets you write, debug, and maintain the rules your system requires.

PC Easy has a chance to catch on in a way other expert-system development packages haven't, partly because it can find its facts in *dBASE III* or *1-2-3* data files. When you write a rule, you specify which facts come from *dBASE*, which come from *1-2-3*, and which will be obtained from the user.

Suppose you are writing an expert system to help select vacation destinations. One of your considerations will be that some visitors may want to stay overnight in national parks. *PC Easy* can look in a database to find out which parks have accommodations and which do not, but it also has to ask the user whether the customer wants to stay in the park or not.

PC Easy turns a rule clause such as *Desire Overnight Stay* into the question "Do you want to stay overnight in the park?" *PC Easy* can further explain "If it is essential that you camp or rent cabin in the park, answer YES. If you can stay outside the park, answer NO."

PC Easy's questions can display as pictures as well as text. Displaying pictures is especially helpful in one of the more widely used expert-system applications: diagnosing mechanical problems.

PC Easy is intended for problems of about 120 rules. The program has a big brother called *Personal Consultant Plus*, which handles larger



Personal Consultant Easy can help users understand the logic behind the rules. Shown here is a rule whose conditions *PC Easy* is trying to satisfy.

problems with many more rules. *PC Plus* also supports expert systems that operate unattended. Users who buy *PC Plus* within 6 months of buying *PC Easy* get full credit against the price of *PC Plus*.

Expert systems do a lot of churning to match facts with rules, which makes *PC Easy* run a bit sluggishly on an AT. The rule editor is awkward. Instead of letting you edit a rule as a

whole, the editor forces you to go through several steps—you choose a part of the rule to work on and choose whether to modify an existing clause or add a new one—before you can get at the text of the rule.

When I misspelled a clause, which resulted in a rule referring to a fact that wasn't available, the editor did not flag the error and I had to run the rule to find out that it did not work.

The Cold Shell of an Expert System

Expert systems aim to condense human expertise into a logic crisp enough to please Mr. Spock of "Star Trek." An expert-system shell helps you write rules to manipulate facts, just as spreadsheets help you write formulas to manipulate numbers. Those rules may seem simple, but the most important ingredient is logical truth.

A travel expert might have a rule: "If you want to visit the Northwest, and you like mountain climbing, and you do not have high-altitude health problems, then you should visit Olympic National Park."

If the conditions on the *if* side of this rule are true, the expert system carries out the ac-

tion on the *then* side and recommends Olympic.

Facts may come from the user or from other rules. A rule to check for altitude problems might be: "If you have a heart condition or you have respiratory problems, then you have high-altitude health problems."

Suppose a user says he likes mountain climbing and would like to visit the Northwest. The expert system considers the first rule above. In order to see if the third clause of the *if* is true or not, it has to investigate altitude problems. The *then* side of the second rule can supply this information. The expert system asks the user about a heart condition and respiratory problems

Since you must tell *PC Easy* about all of the facts before you use them, the editor could check rules to make sure that they do not refer to nonexistent data.

Debugging rules is straightforward. As you answer questions, *PC Easy* remembers all your answers. You can replay the dialog to the point of error and check the rule.

There are many opportunities to use expert systems in business. *PC Easy* is a good way to start using this new technology.



FACT
FILE

Personal Consultant Easy,
Version 1.01

Texas Instruments
Data Systems Group MS 2244
P.O. Box 2909

Austin, TX 78769
(800) 527-3500

Requires: 512K RAM, two disk drives, CGA or EGA displays (for graphic user interfaces), DOS 2.0 or later.

List Price: \$495

In Short: An excellent expert-system shell that lets you write programs to mimic human reasoning. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

in order to draw a conclusion about high-altitude health problems.

The expert system matches the data against rules whose *then* side meets the goal. If the conditions on the *if* side are true, the *then* side is satisfied and the goal has been reached. If the goal is not satisfied, the expert system looks for rules whose *then* sides could supply information it needs and looks at their *if* sides. If there are no rules that could supply the facts, it asks for information from the user.

This process of chaining from the *if* side to the *then* side continues until the expert system either reaches its goal or runs out of rules and fails.

—William Taylor

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NEW ON THE MARKET

AST Research's 80386 Machine Provides 20 MHz Speed and an Enhanced AT Bus

Most of the 80386 machines so far announced are basically AT-class machines equipped with the state-of-the-art processor. A new system from AST Research goes beyond the standard AT bus and offers features similar to—but not compatible with—IBM's Micro Channel architecture.

The AST Premium/386 runs at 20 MHz and has an arbitrated bus that AST has dubbed the SMARTslot architecture. Three of the Premium/386's four AT-compatible slots provide external devices with a direct path to system memory, with no CPU involvement. These SMART-slots support intelligent coprocessors for graphics, communications, and other uses.

Some processing chores can be offloaded to the coprocessors, leaving the CPU free for other tasks.

The system also has two standard 8-bit XT-compatible slots and a single 32-bit slot dedicated to memory.

The Premium/386 comes in four basic configurations. The Model 300 (\$4,695) comes with 1 megabyte of RAM and a 1.2-megabyte floppy disk drive. The \$5,695 Model 340 adds a 40-megabyte hard disk and controller. The Model 390 (\$7,695) has 2 megabytes of RAM, a 90-megabyte ESDI drive, and an ESDI controller. The top-of-the-line Model 3150 (\$8,995) has a 150-megabyte ESDI hard disk and an AST advanced disk

The AST Premium/386 (\$4,695 for the base configuration) has a new arbitrated bus design that supports multiple coprocessors. The system runs at 20 MHz.

controller card.

All Premium/386 machines come with two RS-232C ports and a parallel port. They also have sockets for the 8-MHz 80287 coprocessor and the 20-MHz 80387 chip.

List Price: AST Premium/386 Model 300, \$4,695; Model 340, \$5,695; Model 390, \$7,695; Model 3150, \$8,995. AST Research Inc.,



2121 Alton Ave., Irvine, CA 92714; (714) 863-1333.

CIRCLE 448 ON READER SERVICE CARD

PS/2 Internal Modem From GammaLink Can Transmit at 9,600 bps

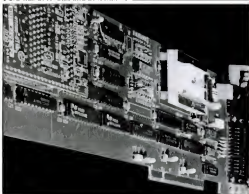
GammaLink has unveiled a 9,600-bit-per-second synchronous internal modem for the Micro Channel bus. It is intended for users who need to exchange data with mainframes.

The \$1,595 GammaComm PS/2 has auto-dial and automa-

tic fallback to lower transmission speeds. GammaLink says the modem is compatible with software that supports the IBM multiprotocol adapter.

List Price: GammaComm PS/2, \$1,595. Requires: IBM PS/2 Model 50, 60, or 80. GammaLink, 2452 Embarcadero Way, Palo Alto, CA 94303; (415) 856-7421.

CIRCLE 450 ON READER SERVICE CARD



The GammaComm PS/2 is the first synchronous internal modem available for the Micro Channel bus. The \$1,595 board transmits at up to 9,600 bits per second.

386 Laptops from Toshiba, Grid Systems Supply Easy Portability for the Power User

Compaq's 80386 portable is a tough act to follow, but new machines from Toshiba America and GRID Systems Corp. pack plenty of power themselves.

GRiD's GRiDCase Model 1530 runs an 80C386 processor at 12.5 MHz. The \$4,695 machine weighs 12 pounds, GRiD says, and runs 1 to 4 hours on its optional battery.

The Model 1530 has an 80-column by 25-line supertwist backlit LCD. Also standard are 1 megabyte of RAM and two 1.44-megabyte 3½-inch floppy disk drives. The system case is made of magnesium.

Options include 10- (\$775), 20- (\$1,175), or 40-megabyte (\$1,675) internal hard disks; a \$395 internal 1,200-bit-per-second modem; and an 80287 math coprocessor.

Meanwhile, Toshiba's entry in the 386-to-go arena is its \$6,499 T5100. It runs at 16 MHz and sports 2 megabytes of

RAM, a 40-megabyte hard disk, and a 1.44-megabyte 3½-inch floppy disk drive.

The Toshiba T5100 has a built-in EGA adapter and high-resolution gas plasma display. The screen supports 640 by 480 bit-mapped graphics and 80-column by 25-line text.

Ports for an external EGA monitor and 101-key keyboard are standard. The T5100 weighs 15 pounds and does not run on batteries.

List Price: GRiDCase Model 1530, \$4,695. GRiD Systems Corp., 4721 Lakeview Blvd., P.O. Box 5003, Fremont, CA 94537-5003; (800) 222-GRiD.

CIRCLE 446 ON READER SERVICE CARD

List Price: Toshiba T5100, \$6,499. Toshiba America Inc., Information Systems Div., 9740 Irvine Blvd., Irvine, CA 92718; (800) 457-7777.

CIRCLE 447 ON READER SERVICE CARD

PS/2 Extension Cables Put Distance Between Keyboard, Monitor, PC

Curtis Manufacturing Co. offers extension cables for the IBM PS/2 line that allow users flexibility in placing their monitors, keyboards, and CPUs.

The EC-9 keyboard/mouse extension cable is fully shielded and extends up to 9 feet. It has mini DIN 6-pin male and female connectors.

The EC-10 color or mono-

chrome extension cable extends to 6 feet and has male and female 15-pin connectors.

Each cable has a suggested retail price of \$39.95.

List Price: EC-9 keyboard/mouse extension cable and EC-10 color or monochrome extension cable, \$39.95 each. **Requires:** PS/2 Model 30, 50, 60, or 80. Curtis Manufacturing Co., Inc., 305 Union St., Peterborough, NH 03458; (603) 924-3821.

CIRCLE 452 ON READER SERVICE CARD



Extension cables from Curtis Manufacturing give users some freedom in setting up their systems. The cables extend the distance that monitors and keyboards can be from the PC.

Excel Plug-in Provides A Link to Databases on Minicomputer Systems

Multiplex/XL, a \$99 add-in to Microsoft's recently announced *Excel*, links *Excel* spreadsheets directly to corporate databases on departmental computers.

Multiplex/XL, from Network Innovations Corp., allows the user to request host data by entering SQL queries directly into a spreadsheet. Or the user can select from a menu of predefined host database requests. After the query is executed, **Multiplex/XL** creates an *Excel* document that contains the query results. The user can bring the query results directly into the current spreadsheet, if desired.

Multiplex/XL uses the dynamic data exchange (DDE) feature of *Microsoft Windows*, Version 2.0. An *Excel* macro passes the request from the spreadsheet to **Multiplex/XL** via DDE.

List Price: **Multiplex/XL**, \$99. **Requires:** *Microsoft Excel*; *Microsoft Windows*, Version 2.0;

80286 or 80386 PC; midrange host that supports **Multiplex** host software. Not copy protected. Network Innovations Corp., 20863 Stevens Creek Blvd., Cupertino, CA 95014; (408) 257-6800.

CIRCLE 451 ON READER SERVICE CARD

ARCnet Interface Card For Micro Channel Bus Places PS/2s into LANs

Pure Data has introduced an ARCnet interface card that connects the IBM PS/2 Models 50, 60, and 80 to ARCnet LANs. The \$895 PDluC508 card has diagnostic LEDs, which monitor network activity, on the rear bracket of the card. The card is configured from menu-driven software, so the user does not need to set DIP switches.

List Price: PDluC508, \$895. **Requires:** PS/2 Model 50, 60, or 80. **Pure Data Ltd.**, 1740 South I-35, #140, Carrollton, TX 75006; (214) 242-2040.

CIRCLE 449 ON READER SERVICE CARD

NOT PROSPECT

Intel Paves an Inexpensive 386 Upgrade Path for 8088-Based PCs

The original IBM PC seems more and more like the Model T of the microcomputer industry. The old classic simply can't keep up in today's fast lane. But **Intel Corp.** has announced an 80386 upgrade that brings your PC up to modern performance standards.

The Inboard 386/PC provides a tenfold performance boost to IBM PCs, XT's, and 8088 compatibles from Compaq and Tandy, Intel says. It does not work with 8086-based machines, nor in compatibles where the processor is socketed to the system board.

This \$995 add-in board installs in an expansion slot. A ribbon cable attaches the Inboard 386/PC to the PC's motherboard, and an adapter plug replaces the original 8088 processor. The Inboard 386/PC has a socket for an optional 80387 math coprocessor; a prying tool is supplied for removing the 8088.

The board comes with 1 megabyte of 32-bit memory, which can be configured as conventional, expanded, or extend-

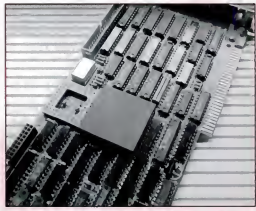
ed memory. The host machine's 8-bit memory is disabled in favor of the RAM supplied with the board, in order to increase system throughput. An optional piggyback memory card can hold an additional 2 megabytes of RAM.

Intel says that the Inboard 386/PC gives access to the virtual mode of the 80386 processor, and multitasking is possible with appropriate software such as Quarterdeck's *DESQview*, Version 2.01. Intel worked with Microsoft to ensure that the board will run under OS/2, but no version of the operating system for the Inboard 386/PC has been announced.

Installation is switchless and requires no hardware upgrades (except that a larger power supply may be needed for some of the oldest PCs).

List Price: Inboard 386/PC, \$995. **Requires:** IBM PC, XT, or 8088 compatible; expansion slot. Intel Corp., Mail Stop C03-07, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; (800) 538-3373.

CIRCLE 448 ON READER SERVICE CARD



The Inboard 386/PC, from Intel, can bring your lumbering 8088 PC up to 80386 speed. The \$995 add-in card comes with 1 megabyte of high-speed 32-bit memory.

PC UPDATE

edited by Peggy Gavan

**WordStar
2000 Plus,
Release 3**

WordStar 2000 Plus, Release 3, delivers a core word-processing program with more than 400 enhancements, plus several companion productivity programs. The first version of Release 3, the Personal Edition, includes *Show-Text*, *Fill-a-Form*, and *PC-Outline* and is priced at \$495. A Legal Edition, priced at \$595, is also available and includes *Compare-Rite*, *Cite-Rite*, *Fill-a-Form*, and a legal dictionary. In addition, MicroPro has incorporated *Cruise Control* and *InSer* into the new release. Registered users can buy either version for \$149 by calling (800) 227-5609, ext. 790. MicroPro International Corp., San Rafael, Calif.

**Ioline LP4000,
LP3700**

Ioline Corp. has added Hewlett-Packard Graphics Language emulation to its **LP4000** and **LP3700** large-format pen plotters. The enhancement adds support for a command set that



Ioline Corp.'s LP4000 (above) and LP3700 large-format pen plotters now emulate the Hewlett-Packard Graphics Language.

is compatible with computer-aided design and drafting programs such as *AutoCAD*, *VersaCAD*, and *Cadkey*. Current owners can purchase an HPGL ROM set for \$150. Ioline Corp., Lynnwood, Wash.; (206) 775-7861.

GammaFax

GammaFax, the industry's first PC-to-FAX product, now has advanced background operation through the use of SoftLogic's *Double-DOS* multitasking program. **GammaLink** is shipping the background enhancement as a standard feature of **GammaFax**, which is priced at \$995. The upgrade is free of charge to registered users. **GammaLink**, Palo Alto, CA; (415) 856-7421.

**Chauffeur HT,
HT Short,
H Card**

STB Systems has reduced the prices on its entire line of monochrome graphics adapters. The **Chauffeur HT**, originally priced at \$249, is



The **Chauffeur HT** board is one of three STB monochrome graphics adapters affected by recent price reductions.

now \$219, and the **HT Short** was reduced \$25, to \$199. STB also cut \$20 off the **H Card**, which is now selling for \$179. STB Systems, Richardson, Tex.; (214) 234-8750.

IN BRIEF

Video-7 has reduced the prices of its **VEGA** and **VEGA Deluxe** graphics cards by \$150 and \$120, respectively. The new prices are \$249 and \$379. **Video-7 Inc.**, Fremont, Calif.; (415) 656-7800. . . **Migent's In-House Accountant**, Version 2.1, adds several enhancements, including a point-of-sale invoicing system, audit trailing, and support for the Hercules Graphics Card. Registered users can upgrade to the \$199 product for \$89, or for \$26 if an earlier version was purchased after Oct. 26. **Migent Inc.**, Incline Village, Nev.; (702) 832-3700. . . **SOS**, Version 2.0, adds several enhancements, including an option to save values only or formulas only and customized warnings when a major change is about to take place. Upgrades are available to registered users for \$20. **Goldata Computer Services**, Bryn Mawr, PA; (215) 525-1036.

PS/2 WATCH

**SCO Xenix
System V**

SCO Xenix System V is now available for the **PS/2 Models 50, 60, and 80**. The new versions, **SCO Xenix 286** and **SCO Xenix 386**, offer true multitasker and multitasking capabilities and use full memory protection. The retail prices of the 80286-based and 80386-based operating systems are \$695 and \$795, respectively. The prices of a complete system, which adds a development system and a text processing system to either version, are \$1,495 and \$1,695, respectively. The Santa Cruz Operation Inc., Santa Cruz, Calif.; (408) 425-7222.

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*Michael Abrash,
Programmer's Journal* ”

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Technical Specifications

- ✓ **Compiler:** One-pass optimizing compiler generating linkable object modules. Included is Borland's high-performance Turbo Linker[™]. The object module is compatible with the PC-DOS linker. Supports tiny, small, compact, medium, large, and huge memory model libraries. Can mix models with near and far pointers. Includes floating point emulator (utilizes 8087/80287 if installed).
- ✓ **Interactive Editor:** The system includes a powerful, interactive full-screen text editor. If the compiler detects an error, the editor automatically positions the cursor appropriately in the source code.
- ✓ **Development Environment:** A powerful "Make" is included so that managing Turbo C program development is highly efficient. Also includes pull-down menus and windows.
- ✓ **Links with relocatable object modules** created using Borland's Turbo Prolog[™] into a single program.
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Sieve benchmark

	<i>Turbo C</i>	Microsoft [®] C
Compile time	2.4	13.51
Compile and link time	4.1	18.13
Execution time	3.95	5.93
Object code size	239	249
Execution size	5748	7136
Price	\$99.95	\$450.00

*Benchmark run on an IBM PS/2 Model 60 using Turbo C version 1.0 and the Turbo Linker version 1.0, Microsoft C version 4.0 and the MS overlay linker version 3.51.

Minimum system requirements: IBM PC, XT, AT, PS/2 and true computer. PC DOS (MS-DOS) 2.0 or later. 384K.

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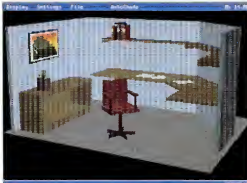
BY JOEL N. ORR

The two D's in CADD stand for *design* and *drafting*. Many CAD programs claim to automate design work but really only mechanize certain aspects of drafting. While there is no widely accepted definition of "design," modeling is generally seen as an important part of the process. And in mechanical and architectural applications, realistic imaging or rendering is essential to modeling.

Autodesk's AutoShade turns three-dimensional AutoCAD "wireframe" files into realistic pictures. You get control over perspective, surface shading, and specular (mirrorlike) reflection.

AutoShade works as a post-processor for AutoCAD drawings, using an AutoLISP function to create an intermediate "filmroll" file while in AutoCAD. The filmroll contains the 3-D wireframe, along with the "lights" and "cameras" AutoShade uses to generate the shaded image.

Within AutoCAD, you create a 3-D wireframe image,



Autodesk's AutoShade adds perspective, specular reflection, and surface shading to AutoCAD 3-D drawings for generating realistic models.

Then you place camera and light symbols to indicate the desired viewpoint and light sources for the shaded image. An image with a camera and lights is called a "scene"; each filmroll can contain any number of scenes.

You can place both "point" and "directed" light sources within a scene, and you can control their position and intensity. Light emanates in all directions equally from a point light source, and in parallel lines—in

the selected direction—from a directed light source.

The camera is controlled by parameters that emulate those of a real camera. You specify a lens size, using "focal length" in millimeters.

Once a filmroll is constructed, you leave AutoCAD and enter AutoShade. Here you load a filmroll and select a scene to work on. Menu options allow you to view a wireframe version of the scene, verifying that the camera angle and lens size will

produce the effect you are seeking before initiating the time-consuming shading process.

Next, you use an option called Fast Shade to get a quick impression of the effect of the "lights" you've placed. Fast Shade shades correctly but does not perform the complex calculations that determine which objects are seen and which are hidden by other objects.

Once you are happy with the camera and lighting parameters, you select the Full Shade option. A complex scene can take many minutes to be rendered in this mode.

Amazingly powerful, this inexpensive program will prove a boon to almost all serious AutoCAD users. AutoShade's design reduces the tedium of working with what has always been a slow process.

PC FACT FILE

Autodesk Inc.

2320 Marinship Way
Sausalito, CA 94965
(415) 331-0356

AutoShade

List Price: \$500

Requires: AutoCAD, Release 9 or Version 2.62.

In Short: A postprocessor that creates color models of AutoCAD 3-D files. Not copy protected.

CIRCLE 443 ON READER SERVICE CARD

AutoCAD, Release 9

List Price: \$2,850; upgrade from Version 2.62, \$150; from Version 2.5, \$250; from Version 2.18, \$350.

Requires: 512K RAM, hard disk drive, graphics adapter, math coprocessor, DOS 2.1 or later.

In Short: A major upgrade to the most popular PC CAD program. Release 9 improves file sharing, speed, and interface and adds splines. Not copy protected.

CIRCLE 444 ON READER SERVICE CARD

An AutoCAD Milestone: Release 9 Adds Splines, Brings Menus into Modern Age

Autodesk is so proud of the changes it has made to its AutoCAD program that a new version number wasn't enough to convey the improvement; a new numbering system had to be created. Release 9 picks up where Version 2.62 left off, and the name signals AutoCAD's awakening into the modern age of PC interfaces. That's welcome news, but it's only part of the story.

The most important change will be invisible to most AutoCAD users: You can now transfer drawing, font, shape, menu, slide, and binary drawing files among Sun, DEC, Apollo, and DOS AutoCAD systems with no changes or intermediate steps,

making seamless networking possible.

Another important addition is the "spline" curve. It uses the vertices of a selected polyline as the "frame," or defining points, of a cubic B-spline. In this type of object, the first and last points reside on the curve, while the other points seem to exert a pull on the line but are not necessarily on it.

The most visible new features are in the interface. Pull-down menus help you keep your orientation, selecting 3-D views without losing sight of the program's other options. You can customize pull-down and icon menus, so skilled users can set up systems for less-skilled oper-

ators. Slide files are used to create menu icons; for instance, a hatch pattern can be saved as a slide file and then used in creating the menu.

Release 9 is also faster than prior releases because it uses inline floating-point instructions throughout. But it cannot run on systems that lack a math coprocessor.

The effect of these changes is to make AutoCAD more of a large toolbox than a tool. Novices may quickly get lost without guidance; thus the interface improvements and the ability to customize the interface are necessary and welcome. Old hands may prefer to ignore the pull-down menus, but they're free to enter commands the old way and enjoy the improved performance. —Joel N. Orr

Paradox: The perfect relational database manager for both novices and advanced users

Paradox® is so technically advanced that it's easy to use.

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CIRCLE 510 ON READER SERVICE CARD

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COMMUNIQUÉS

edited by Bill Howard

The Amazing Ginsu Mouse from Ronco



"A house for your mouse, makes it more practical, more convenient to use. When the surface is not smooth, it has its own running pad. Flip the pad, and you have a very convenient cutting pad."

—Ad for Genius mouse and mouse pad.

Amazing Facts I

"The [Amstrad PC1512DD] dual drive allows you to use two disks at the same time and run two programs at once."

—Goldsmith's ad, Commercial Appeal (Memphis), September 20, 1987

Amazing Facts II

"Because [G.O.A.L.S. software] is written in D Base III it automatically interfaces with Lotus 1-2-3 . . ."

—Associated Systems ad, Oil & Gas Journal, October 12, 1987

Let Him Without Sin Cast the First Stone

"Don't trust your valuable data to Taiwanese 386s—when you need tech support on a 386, you want to call a factory in the USA, not Taiwan . . ."

"Micro I sells to many developers, OEM's and sophisticated VAR's: when they have an engineering or tech support question, it's nice to call knowledgeable technician who speak clear English."

—Micro I ad, Bay Area Computer Currents, September 22, 1987

Desktop Publishing In A Box

The Cordata Intellipress: A Low Cost, Turkey Solution

Headline, Computer Shopper, November 1987

Classified Intelligence

Candy Colored Computer 2, printer, 10 games . . . \$200.

—Trading Times (Detroit, Mich.), September 24, 1987

Computerized Design Drafting

Immed. need for expd. Drafters. 1-5 yrs. exp. Call xxx-xxxx EOE.

—Denver Post, October 14, 1987

18 Character Daisy Wheel Printer, \$99.

—California Digital ad, Byte

Office Person for manufacturer . . . Experience with spread sheets, facts and IBM PC's helpful.

—The Coloradoan (Fort Collins, Colo.)

Deaths, Funerals

Commodore 128 & 157 I discribe, speech synthesizer . . . xxx-xxxx

Toner cartilages recharged for \$59. Mid Atlantic Teles xxx-xxxx.

—The Washington Post, October 21, 1987



"It's really very simple. Miss Wayne. You just move the cursor over the screen to the area of the world you wish to destroy."

Have you heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? If so, send your offerings to *Communiqué*, PC Magazine, One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Please print your name legibly; include the name, city, and publication date of any newspaper clipping; and include your T-shirt size. Contributors will receive \$50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries can't be acknowledged. And please do not submit any more classified ads for sloppy drivers, cereal printers, or haze modems.

Winners for this issue: Bob Dushman (Genius mouse), Judith Anderson (turkey system), David Pipe (facts experience), Lisa Patton (toner cartilages), Mahmud Rahmon (Candy computer), Karen Vendell (computerized design drafting), Carolyn Boyles (Commodore deaths), Paul Nutterfield (18-character printer), James Minchey (Amstrad dual drive), David Poole (DRASE interface), Monty Stewart (knowledgeable technician).

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\$129**

- **EEMS RAM CARD FOR AT**
16-bit 2 MB extended or expanded memory per card and up to 4 cards per PC/AT. Software supported: DESQVIEW, Framework, Symphony and Lotus 1-2-3, plus others. Supports speeds of 10 MHz on PC AT. Board comes with O.K.

\$159**

- **EEMS RAM CARD FOR 386 SYSTEM**
32-bit 2 MB extended memory card for the 386 AT system board.

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Memory expansion up to 640 K/576 K DRAM. Boards come with O.K. memory.

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- **300/1200 BAUD MODEM**
Halfsize internal Hayes compatible. Includes communication software.

\$89**

- **PC OPTICAL MOUSE**
Dr. HALO software included. 200 dots/inch.

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- **GENIUS MOUSE**
Dr. HALO software included. 200 dots/inch. Mouse Systems & Microsoft compatible.

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Real time clock/calendar for PC/XT. Uses no slot. Includes software.

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- Compatible with any Xenix supported terminal/device
- Includes drivers for (Santa Cruz) SCO Xenix V2.2 and Microsoft Xenix V2.

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Accelerates your PC/XT to faster speeds than AT. 80286/80386 mode switchable. Clock speed: 10 MHz. 8 KB of high speed 0 wait state cache memory. Support for 80287 running at 6 or 10 MHz.

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14 MHz Throughput**

Same configuration as in System 286-16 except,
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System Price \$1179⁰⁰

STANFORD 286-10/1

**6/10 MHz Zero Wait State
12 MHz Throughput**

Same configuration as in System 286-16 except,
■ 6/10 MHz clock w/0 wait state
■ 640K 100 Nano Seconds, 0 wait state DRAM installed, expandable to 1024KB

System Price \$1049⁰⁰

STANFORD 286-10/2

6/10 MHz

Same configuration as in System 286-16 except,
■ Regular size AT main board & chassis
■ 640K (120 N/S) DRAM on board
■ Phoenix BIOS

System Price \$949⁰⁰

STANFORD 4.7/10

- 4.7/10 MHz, software switchable M/B
- Phoenix BIOS, Norton SI:3.3
- Socket for 8087 math co-processor
- 640K 120 N/S DRAM on board
- Floppy drive controller
- 360K floppy drive
- XT/XT style keyboard
- AT Jr. case, XT size with AT features
- Hardware Reset and Turbo L.E.D.
- Keyboard lock, Power LED
- 150 watt power supply
- 8 expansion slots
- High quality, heavy duty packaging

System Price \$529⁰⁰

STANFORD 286-16

**10/12 MHz Zero Wait State
16 MHz Throughput**

- Compact size AT main board
- Intel 80286-12 CPU, 10/16 MHz software (keyboard) switchable clock
- Award BIOS, Norton SI:15.8
- 1024KB (one megabyte) 80 Nano Sec. on-chip, 0 wait state DRAM, installed
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port, and game port
- 8 expansion slots (5-16 hits, 2-8 bits)
- Built in setup program
- Clock/calendar with rechargeable battery backup
- Hardware Reset and Turbo L.E.D.
- Selectable between zero wait state (10/16 MHz) or one wait state (8/12 MHz)
- Socket for 80287 math co-processor
- 180 watt power supply
- Enhanced keyboard (101 keys)
- Complete documentation
- High quality, heavy duty packaging

System Price \$1444⁰⁰

NETWORKING

STANFORD INTELLIGENT NET-II CARD

Ether Net/Cheaper Net specification, 80186 processor & 82586 LAN coprocessor on board. Protocol: CSMA/CD, IBM NET BIOS compatible. Data transfer rate: 10 MB/s. Network software compatibility: PC-NET, MS-NET, Novell's Advanced Network.

\$499⁰⁰

STANFORD 4.7/18

Same configuration as 4.7/10 MHz XT, except,

- XT slide case
- 640K 150 N/S DRAM, Norton SI:1.7
- Standard or Phoenix BIOS

System Price \$474⁰⁰

STANFORD 386-18

**9/18 MHz Zero Wait State
21 MHz Throughput**

- Intel 32 Bit 80386 CPU (18 MHz), 9/18 MHz software (keyboard) switchable clock
- Norton SI: 21 (Processor Speed)
- 200 watt P.S., 110/220V selectable
- CMOS memory, 16 channel interrupt, 7 DMA channels
- 512K interleaved 32 bit RAM on board
- RAM can be expanded to 16 MB of 32 bit high speed interleaved memory
- 2-32 bit, 4-16 bit & 2-8 bit expansion slots
- Supports 80387 math co-processor
- Phoenix or Award BIOS
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port, & game port
- Hardware Reset and Turbo L.E.D.
- Clock/calendar with battery backup
- Enhanced keyboard (101 keys)
- Complete documentation included
- High quality, heavy duty packaging

System Price \$2058⁰⁰

STANFORD 386-16/1

**6/16 MHz Zero Wait State
19 MHz Throughput**

Same configuration as in System 386-18 except,

- Intel 32 Bit 80386 CPU (16 MHz), 6/16 MHz software (keyboard) switchable clock
- Norton SI: 18.7 (Processor Speed)

System Price \$1979⁰⁰

STANFORD 386-16/2

Same configuration as in System 386-16/1 except includes socket for 80287 math co-processor.

System Price \$1884⁰⁰

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- **EEMS RAM CARD FOR AT**
16-bit 2 MB extended or expanded memory per card and up to 4 cards per PC/AT. Software supported: DESQVIEW, Framework, Symphony and Lotus 1-2-3, plus others. Supports speeds of 10 MHz on PC AT. Board comes with O.K.

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STANFORD 286-12

6/12 MHz Zero Wait State
14 MHz Throughput

Same configuration as in System 286-16 except,

- 80286-10 CPU, 6/12 MHz Switchable

System Price **\$1179⁰⁰**

STANFORD 286-10/1

6/10 MHz Zero Wait State
12 MHz Throughput

Same configuration as in System 286-16 except,

- 6/10 MHz clock w/1 wait state
- 640K 100 Nano Seconds, 0 wait state DRAM installed, expandable to 1024KB

System Price **\$1049⁰⁰**

STANFORD 286-10/2

6/10 MHz

Same configuration as in System 286-16 except,

- Regular size AT main board & chassis
- 640K (120 N/S) DRAM on board
- Phoenix BIOS

System Price **\$949⁰⁰**

STANFORD 4.77/10

- 4.77/10 MHz, software switchable M/B
- Phoenix BIOS, Norton SI-3.3
- Socket for 8087 math co-processor
- 640K 120 N/S DRAM on board
- Floppy drive controller
- 380K floppy drive
- AT/XT style keyboard
- AT Jr. case, XT size with AT features
- Hardware Reset and Turbo L.E.D.
- Keyboard lock, Power LED
- 150 watt power supply
- 8 expansion slots
- High quality, heavy duty packaging

System Price **\$529⁰⁰**

STANFORD 286-16

10/12 MHz Zero Wait State
16 MHz Throughput

- Compact size AT main board
- Intel 80286-12 CPU, 10/16 MHz software (keyboard) switchable clock
- Award BIOS, Norton SI-3.3
- 1024KB (one megabyte) 80 Nano Secs, 0 wait state DRAM, installed
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port, and game port
- 8 expansion slots (6-16 bits, 2-8 hit)
- Built in setup program
- Clock/calendar with rechargeable battery backup
- Hardware Reset and Turbo L.E.D.
- Selectable between zero wait state (10/16 MHz) or one wait state (8/12 MHz)
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- Enhanced keyboard (101 keys)
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- CMOS memory, 16 channel interrupt, 7 DMA channels
- 512K interleaved 32 bit RAM on board
- RAM can be expanded to 16 MB at 32 bit high speed interleaved memory
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- Phoenix or Award BIOS
- High capacity floppy controller card
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Same configuration as in System 386-16/1 except includes socket for 80287 math co-processor.

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A quarterly
publication of
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authors of the PC Paintbrush
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ZSoft Announces New

Windows Products
 MC FrontBase® and PL FrontBase®: ZSoft's best-selling database and graphics post programs are now available as applications running under Microsoft® Windows Operating Environment.

PC. Patchwork for Windows offers all the features of the industry-standard PC Patchwork program, including on-line parts, Worksheet draw, fixed files, notes, circles, lines, text, and more. PC Patchwork+ for Windows has all the capabilities of PC Patchwork for Windows and adds image-to-text support.

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Publisher's Partnerships supports the new HTML display adapters for the models 90, 90i, and 90c in all WebTV software and HTML WebTV content.

The PNT's graphic media are of special interest to desktop publishers. The 44000-resolution media provides square pixels on the screen. When the pictures are printed on a 300-dpi printer such as a laser printer "What You See Is What You Get," round circles on the screen are really round circles on the printed too.

PC, Postscript, PC Postscript, and Publisher's Postscript are all available on either 3.5- or standard 5.25-diskette. Give us a call if you need to upgrade your current version as needed to the next incarnation.

Zibit Corporation can be reached by phone at (404) 426-0000, or by mail at 450 Franklin Rd., Suite 100, Marietta, Georgia 30067.

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PC Paintbrush + reduces your memory requirements to 512K by trading off zoom-out editing and some typographic features. Like Publisher's Paintbrush, it supports gray-scale and R/W image scanners.

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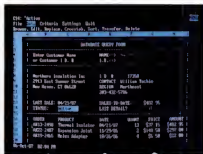
Both PC Paintbrush and PC Paintbrush + are now available as Windows applications. They have all the features of our DOS products and the ability to "communicate" seamlessly with other Windows applications.



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dBASE Power for 1-2-3

Last year we met a crazy programmer who said he could build a database with the power and capacity of dBASE and put it *inside* 1-2-3. Well, he works for us now, and if you know anything about database programs, his baby is going to knock your socks off.

Introducing @BASE, a full-feature relational database add-in for 1-2-3. Now anyone who knows how to use 1-2-3 is an instant database wizard because @BASE turns 1-2-3 into a powerful "front-end" for database applications. *It's as easy as 1-2-3.*

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If you've every tried to use 1-2-3 as a database manager, there's a good chance you've run out of memory. That's because 1-2-3 stores data in the worksheet. @BASE stores data on disk where record capacity is virtually unlimited. You'll never run out of memory again.

Brains and brawn

@BASE compares with powerful standalone database programs like dBASE or R:BASE,® but it operates in concert with 1-2-3. You get the best of both worlds: 1-2-3 gives you tools for data analysis. @BASE gives you big data capacity. Brains and brawn. It's a nice combination.

In minutes you can build a worksheet with dynamic links to the database on disk. (The worksheet might present a sales recap by region.) Next month, for up-to-date results, simply

load and recalc the worksheet. Fresh database information is automatically linked from disk.

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@BASE uses exactly the same file format as dBASE III and dBASE III Plus. *dBASE is not required to use @BASE.* But if you have standardized on dBASE, @BASE fits right in. @BASE reads and writes dBASE files directly. No conversion is necessary.

At less than a third the cost of dBASE, you may decide to use @BASE instead of dBASE throughout your organization wherever users need easy access to dBASE information.

Serious Performance

@BASE beats dBASE III Plus in benchmark tests.* @BASE is up to 3.7 times faster!

	dBASE III Plus	@BASE
Locate record	12 sec	12 sec
Pack database	7.1 min	1.9 min
Sort database	10.8 min	4.5 min

*Test with 4,000 records, 34 fields per record

@BASE works with 1-2-3 Release 2 on the IBM PC, XT, AT, PS/2 and compatibles. Only \$195. No competing add-in database can match @BASE for power, compatibility and performance. *Nothing even comes close.*

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- Use 1-2-3 as a "front-end" for existing dBASE applications.
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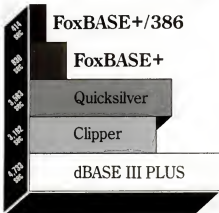
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**dBASE Users!
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Data Based Advisor



BYTE Magazine

FoxBASE+ Fastest By Far

BYTE* benchmarks show that FoxBASE+ takes only 14 minutes to do what dBASE III PLUS needs an hour to do. The others are even slower. Clipper needs an hour and 17 minutes. Quicksilver needs an hour and 40 minutes.

Nobody beat FoxBASE+ in *even one* of the 27 BYTE benchmarks.

FoxBASE+ zipped through the exhaustive Data Based Advisor** benchmarks in just 15.5 minutes. New FoxBASE+/386 ran them in only 7 minutes! By contrast Clipper took 53

minutes, Quicksilver took 59 minutes, and dBASE III PLUS took an hour and 18 minutes.

Why Waste Your Time?

BYTE's data shows FoxBASE+ is up to 7 times faster. DBA's benchmarks show FoxBASE+ is over 5 times faster.

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Quicksilver is a trademark of WordTech Systems.

*Using the benchmark timings published in BYTE, September 1987.

**Using the suite of benchmarks published in Data Based Advisor, March 1987.

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■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

WAGING WORKSTATION WARFARE



Will the PC ever be a workstation? Some say yes, others disagree. Still others ask, What is a workstation, anyway, and why would a PC want to be one?

Workstations are hard to describe, but I know one when I see one.

Where you see workstations is often more important than what they're doing. They lurk on engineers' desks or deep in the bowels of the computer science department at the university. They're distinguished by large monitors, mice, and dazzling graphics displays. They usually connect to some larger computer running UNIX or VMS. The connection may be anything from RS-232 to Ethernet. Many workstations run UNIX locally, as well. One of the more mundane applications of workstations is simply putting a pretty face on ugly old UNIX.

UNIX is the birthplace of work-group computing and remains the operating system of choice for most scientific and engineering computing. The confluence of UNIX and scientific computing was a natural for the invention of the workstation. The UNIX community of the time had the best and brightest programmers, electrical engineers, and original thinkers. The programmers wanted better tools. The engineers wanted better graphics. The original thinkers wanted to change the world.

Programmers wanted and needed to work on more than one thing at a time. They talked to their minicomputers through RS-232 terminals. They could have had multiple terminals, but that was a kludgy solution. Better to have an intelligent terminal that could manage multiple host sessions, preferably in windows on a single screen. Then they could see their compiles executing in one window, edit programs in another, pull some code out of

an old program in a third, and track system usage in a fourth.

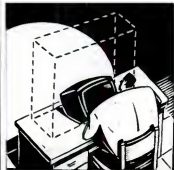
Engineers, meanwhile, were tapping the incredible potential of computers as design tools. More often than not, they worked through slow, noisy Teletype machines, feeding variables into programs that solved equations, fitted curves, or analyzed variables. They spent hours hand-plotting the resulting data on graph paper or had to put up with period-and-dash character plots on crummy yellow Teletype paper. A few really flush companies could afford the expensive graphics peripherals such as Tektronix vector-based graphics terminals or big CalComp plotters. The engineers knew that pictures spoke more eloquently than rows and columns of numbers, but graphical output was a severely limited resource.

The original thinkers saw the opportunity to apply inexpensive bit-mapped display technology to both problems. Bit-mapped

raster displays don't have the eye-popping pizzazz of vector displays, but they're easier to implement. Their early efforts were display workstations, with little or no local processing beyond what was necessary to convert the host's output into words and pictures. Succeeding generations of products got smarter and smarter, doing a considerable amount of local processing. Lots of innovations crept in from think tanks and development centers such as SRI and Xerox's PARC.

These forces pushed, shoved, molded, and shaped today's workstations. With the advent of microprocessors, workstations got a little smaller and a lot smarter. Microprocessors made local compute power practical and inexpensive. With fast, local disk storage, workstations became mini-computers unto themselves. With built-in networking, they became minicomputers unto one another.

FEELING GUILTY Along the way in creating these masterful workstations, the programmers, engineers, and original thinkers have managed to instill feelings of inferiority in everyone else. They've engendered the sense that unless you're using a workstation you're in the Dark Ages; you might as well be using a keypunch machine. PC managers feel guilty that they're not considering workstations for some of their applications. After all, they see juicy examples of workstations moving into new areas. Brokerage houses are building super transaction-monitoring systems on giant screens, replete with multiple windows, settable alarms, dynamic tracking,



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■ EDITOR'S SCREEN

and more. Engineering teams are designing everything from airliners to air conditioners with CAD. Sure, CAD works on a PC. But it knocks your socks off on a workstation. And desktop publishing, yea, WYSIWYG itself, was born on a workstation. Everything the PC and the Macintosh do with desktop publishing is an imitation or amplification of something that's already been done on a workstation.

GROWING UP? Can the PC become a workstation? What defines the gulf between the PC and a workstation?

A lot has to do with your point of view. For instance, workstation companies sneer at the Macintosh II, despite its having the same processor, math chip, and screen as the leading workstations. Eric Schmidt, Sun Microsystems' vice president of software development, said, "The Mac II is a great box, but it doesn't come anywhere near the power of what I call a workstation." These guys are tough.

He has a point, though. Workstations are mature where it counts most: in workgroup environments. Most of their strength comes from the software, now that fast hardware is a commonplace. Networking among workstations has been raised to a high art form, in both function and on-screen appearance. If you're looking into local area networks, you owe it to yourself to check out the workstation offerings to see what you can't get yet from Novell or 3Com. The best LAN offerings on PCs look wordy and ponderous next to their workstation equivalents.

END OF THE RAINBOW Still, the PC continues to improve. Both the new Compaq Deskpro 386/20 and the Tandy 4000 accept the Weitek 1167 floating-point chip set, the current darling of the number crunchers. You can get the big screens and hi-res graphics cards. You can run UNIX, networks, or standalone DOS applications. The PC approach to workstations is that of the rest of the PC market: an Erector Set. You build what you want, even though you may get it wrong. The workstation vendors have a more polished, refined solution.

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■ JOHN C. DVORAK

SPREADSHEETS? JUST SAY NO!

In this reading from the Gospel According to John, we hear of the dangers of uncontrolled spreadsheet use and other signs pointing to the end of civilization.



This is the kind of column for which I am often criticized. The ideas are too radical—the concept too bizarre. Yet, I'm convinced it's true. I'm convinced that spreadsheet use adversely affects the mind and personality of the user—permanently.

We too often forget that a spreadsheet is not an application, but a programming language—possibly the most unusual language ever devised. You've heard of ASICs (application-specific integrated circuits)? Well, a spreadsheet is an ASL, an application-specific language (I could call it application-specific software, but I refrain).

The application is quasi-matrix processing, and that means more than bookkeeping and conventional spreadsheets. Engineers and scientists in the lab integrate instrument data into cells. Some fanatics have used 1-2-3 as an engine for games. It has many uses as a programming language and environment.

CHANGES IN ATTITUDE A true application is something like a general ledger. It might be written in COBOL, or BASIC, or it might be written as a template for 1-2-3. Here's the first affliction we see amongst the spreadsheet users—the term "template." Because of the personality changes due to spreadsheet use, the users discover a new-found arrogance. Developers of programs for spreadsheets don't program—they produce templates and they "do" macros like yuppies "do" lunch.

To accept the notion that a spreadsheet is a programming language, we must un-

derstand that it is nonprocedural, thus creating a new category of language—a calculation-oriented nonprocedural language. It's presented in the form of a structured (empty) grid for the programmer to fill in the blanks. The order and methodology for insertion is negligible or nonexistent. The potential for creating a mess is high and only the discipline of the programmer prevents havoc. The discipline is there because the spreadsheet is the way orderly bookkeepers think, and the spreadsheet as a concept is their baby.

HOOKED ON A FEELING Couple this fact with the phenomenon of programming in general. Programming means taking control, and it means achieving a feeling of omnipotence. More than a few people become addicted to the "kick" of programming.

When, years ago, Marshall McLuhan said the medium is the message, he meant

that thought patterns created by a medium (such as the linear written word or the nonlinear TV image) would affect the mind of the participant (reader and viewer, respectively).

So, too, with programmers and programming languages. At the extreme, the procedural languages create personalities who become asocial and "too logical." They worship "Star Trek's" Mr. Spock. They are the nerds.

We've all observed this effect and laughed it off. But what about the effect spreadsheet use has on the user? I look around and it's obvious to me: spreadsheet programming is turning the users into humorless accountant types. It is the embodiment of the bookkeeper's thought pattern. If you don't already have this peculiar pattern, then using a spreadsheet for any length of time will slowly turn your mind into the mind of a bookkeeper. The final result is not unlike the creation of mindless pod people seen in *Invasion of the Body Snatchers*.

The spreadsheet matrix is a creative prison bound by A1 and Z1000. Walls. A psychological prison.

Unlike the Black Death, nobody sees this malady. There will be no cure. Soon it will be too late. We'll be surrounded by a world of people talking about the bottom line. It's the death of creativity, perhaps the true end of Western Civilization. Democracy has no meaning to the armies of spreadsheeters—the government is best left to despots.

Welcome to the new age, brother!
And have a Happy New Year.



■ JOHN C. DVORAK

INSIDE TRACK

Is cloning the PS/2 a new direction for Intel? Will Microsoft ever write better drivers for the mouse?

Gurus, pundits, and observers of the micro chip scene all think that the American semiconductor industry is doomed. But like a zombie in a cheap horror film, it just keeps coming at you. The latest ploy to stay mobile may soon be accomplished by Intel. I'm told that Intel is so beleaguered by IBM's demands and so annoyed by Big Blue pulling out its investment that it will go into the manufacture of PS/2 clone chip sets, à la Chips & Technologies.

Remember when Intel was talking about doing those so-called application-specific integrated circuits (ASICs)? Well, what could be a better money-maker than a **PS/2 on a couple of chips?** Interesting development, if true.

Best known for this ploy is Chips & Technologies—more a phenomenon than a company. It's the one that makes the cheap EGA chip set and the AT chip set that you find in the cards and clones everywhere. Others have followed its lead.

It's a PT-boat attitude toward the war of business. The firm can zoom around from one project to another, thanks to the automation of chip design using "chip compilers" that take the design of, say, a PC card and turn it into a schematic consisting of one or two custom VLSI chips. The big companies are now realizing that this is where the action is. Even board makers such as Paradise have noticed this trend and are starting to design chips for resale.

With the formation of many little so-called chip foundries, we are seeing a **replay of aspects of the Industrial Revolution**, where smallish iron foundries were chosen to make manhole covers and other specialty objects that large steel mills had no interest in manufacturing.

It's a fascinating trend to watch. Perhaps a study of the history of the iron foundry will reveal the direction this trend in semiconductors may take.

Genuinely Interesting Software

Dept.: Well, I've heard about software like this and now I've seen it. Developed by a cool-cat Russian immigrant named Vadim Yasinovsky, this program is what the doctor ordered. The version I was shown was called *Clear* and worked with programs written in *dBASE*. Vadim says that by the time you read this, he'll have versions of the program that can do the same thing with BASIC, C, or assembler.

Here's what the program does. It takes the source code from any program and not only disassembles it, but **produces a concise and accurate flowchart of the program.** You know—the kind of chart with the circles, triangles, and squares that shows you how the program is structured. **It's hot! Hot! One PC Magazine** staffer looked at it and commented that you could put the printout on your wall at the office and the boss would be convinced you knew what you were doing. On-screen the software lets you zoom from the flowchart to the code effortlessly.

Call or write today. The *dBASE* version of *Clear* currently goes for a mere \$99. Clear Software Inc., 369 Tappan St., #10, Brookline, MA 02146; (617) 731-6976.

Mouse Dept.: I've not been a big fan of the drivers for the Microsoft Mouse. While Apple has a team of people testing various algorithms that accelerate and decelerate cursor movement when the mouse is used, Microsoft staffs one guy who wrote a simple two-speed driver that moves the cursor real fast or real slow.

The overall feel is **not what it should be.** The Microsoft Mouse is uncomfortable and, therefore, unappealing to the PC user.

Well, Microsoft may have solved some of the "feel" problem without changing software. The new Microsoft Mouse (the one that looks like a bar of Dove soap), with its repositioned ball and seemingly **improved** mechanism, makes all the difference in the world. For the moment, the new Microsoft Mouse is the one to buy. Highly recommended. Note: if you add a mouse to your machine, **get a bus mouse**, not one that attaches to the serial port.

A Real Inside Track Deal Dept.: I have been looking for some acoustic cups that have an RJ-11 jack hooked to them and that can be used with a portable computer and its internal modem. I need this to use at a phone booth or someplace where I can't connect directly into the lines.

I gave up on the idea until I ran into the **Kyocera KM0300A acoustic adapter.** I called the company and asked about these things. "Nobody bought them," I was told. No wonder! Who heard of them? The warehouse has 1500 sets left. "They sold for \$75 a set, but if someone calls and asks for a set we'll sell them for \$30." Now that's a **deal** for you portable users. These things are a must when you're in the boonies. Call Kyocera in California at (408) 437-8777. They're only \$30 while they last. Such a deal.

Honesty Dept.: Success will put these guys out of business, but I get the biggest kick from a **cheap little magazine** called *2600—Journal of the American Hacker*. Great anecdotes about those computer nuts on the edge and hints about putting yourself amongst them. A must for the MIS department as a **counterintelligence aid!** It's \$15 a year from 2600 Enterprises, Box 752, Middle Island, NY 11953.

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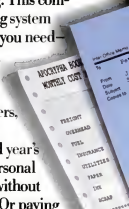
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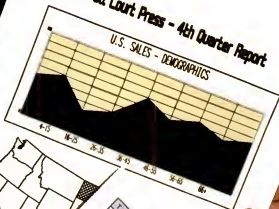


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■ JIM SEYMOUR

SOFTWARE PACKAGING

It's not only what's inside the package that counts. Software publishers need to think more about functional and aesthetic software packaging.



Can we talk a little about what at first seems a mundane topic: software packaging? While PC software has changed for the better over the past 5 years, the hardware upon which we run that software has gotten better, and PC users have gotten more knowledgeable and demanding, one thing that hasn't changed very much is software packaging.

We still see row after row of those damned shrink-wrapped, slipcased, half-size binders on the shelves of software stores. If I never see another one of those dwarf binders in cardboard sleeves, I'll be happy.

They're lousy merchandising tools, they're lousy storage systems, they're lousy at helping us learn how to use the products packed in them—and they cost a small fortune. They're also heavy and ridiculously bulky for what they enclose, as anyone who has had to build or buy more shelves, or who has recently moved, can testify.

THE VENDORS' VIEW Some software vendors stay with those slipcased minibinders because they think they carry with them an air of IBM-ness. True, IBM largely invented this packaging, which was introduced with PC-DOS 1.0 in 1981. And true, early PC applications benefited from the halo effect of packaging that looked like an IBM box. But aren't we past the need for subliminal suggestions that everything new in software comes from Mother Blue's own kitchen?

As IBM-brand applications software for PCs became an industry joke, you'd think

we'd have wised up and begun to find negative connotations in IBM-style packaging. Apparently not, to judge from the software shelves at any computer store. And from the comments by most software vendors when they're asked about their packaging.

I've often kidded software publishers about their packaging. Just as we have overpackaging in fast food—wrap it in paper, put the paper-wrapped food in a little foamed-plastic coffin, stick that coffin in a box, and then put the box in a bag—we find the computer equivalent in overpackaged software.

Vendors hate the idea that we see their products as consumer packaged-goods. But today every PC software package is competing in a consumer packaged-goods environment. Vendors may not like the idea that we pick up the box and study it as we might a box of Tide or a bottle of Ty-Dol, but the fact is that we've been condi-

tioned by decades of experience in the marketplace to judge products first, and in significant measure, by their packages.

ALTERNATIVES We've seen plenty of alternatives, some even worse than slipcased minibinders. And we've seen a few good ideas, the best of which sometimes didn't make it.

For example, about 5 years ago Micro-soft began packing its applications packages in large, clear acrylic boxes that, once opened, became easels to hold the manual open as you learned the program. But they made for big, heavy packages that with fair regularity arrived at dealers' doors cracked or shattered.

The easel function of the plastic box wasn't all that clear to many buyers, who thought it was just an expensive way to box up a manual and some disks. Micro-soft dropped the idea. (And most recently it has gone to the ultimate in consumer-goods packaging: huge, gorgeous, nearly empty boxes, with lovely graphics and four-color photos on the outside and lots and lots of air inside.)

Many programs now come in simple boxes and sleeves. These open-top or open-side boxes let you throw the documentation, disks, templates, etc. into the box, then slip it into an outer sleeve to keep out dust and provide rigidity. I like these a great deal and have found them extremely popular among users.

My current nemeses among software packaging are two cutesy ideas that must have looked good on paper and sounded good when they were pitched to the pub-



■ JIM SEYMOUR

lishers, but in practice have become pains in the backside.

One is Norwesco's Softlock, a clear acrylic box about three-quarters of an inch thick. It locks in the spiral-bound manual

on a captive steel rod and locks in the disks behind a heavy acrylic panel that, when finally removed (and usually broken in the process), serves as a prop to turn the thing into a clumsy easel. Removing the manual

for more-civilized use and storage is a messy job.

The second is Communication Packaging's new gizmo—used by Kortek for *Freeway*—which is minimalist packaging in the extreme. It's a three-sided plastic frame that fits around the open edges of a minibinder, making a rectangular box for the retailer's shelf. You're supposed to be able to slide the binder back in easily, through molded channels. In practice, it's a dexterity test to reassemble.

DOING IT RIGHT What are the keys to good software packaging? Functional, attractive, and appropriately cheap are the tests. Protect the contents, move the goods, and don't pick the customer's pocket with stuff he'll toss after opening.

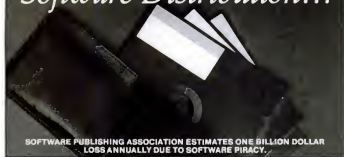
■ The easel function of the plastic box wasn't all that clear to many buyers, who thought it was just an expensive way to box up a manual and some disks.

From Borland's poverty-level packaging (disks tucked inside cheap, perfect-bound manuals that are then shrink-wrapped) to Paperback Software's excellent Disk Packs (oversize paperbacks with disks protected inside a thick chip-board back cover), consumers are responding to less expensive but more appealing packaging.

Good software packaging fairly and enticingly tells us what's inside. It protects manuals, disks, and other pieces of the package till we get them to our home or office. It suggests the intended applications and likely users of the program by reflecting the price, perceived value, and probable market for the program.

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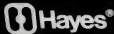
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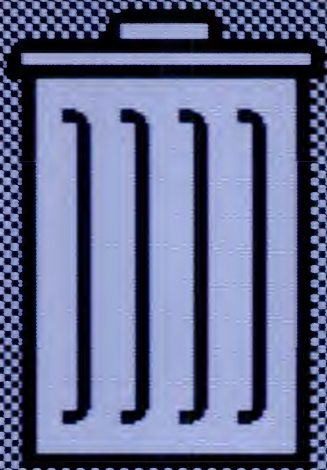
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■ STEPHEN MANES

HO, HO, ETC.: SANTA'S DOWN



Economy measures, network woes, and look-and-feel lawsuits have Santa muttering in his beard. Those darned grinchers are taking over . . .

Ho, ho, boys and girls. Merry Xmas, I guess.

If I sound a little depressed this year, it's because I am. The season and all that. First time ever. Now I know how the rest of the world feels.

This year I have to leave out the traditional third "ho" because my bean-counting grinchers have spreadsheets that say it's not cost-effective. I suppose if you add up all my annual "Ho, ho, hos," you can see what the grinchers are talking about.

Personally, I don't think it's quite the same with just two "ho's." But enjoy 'em while you can. Next year I may be down to just one "ho," though I'm positive that'll just open us up to offshore competition.

LOOK AND FEEL Then there's this disheartening look-and-feel thing. The grinchers have brought it to my attention that thousands of impersonators worldwide have cloned my look and feel under the guise of "Santa's helpers" and "Santa's friends" and even Santa himself. Worse, I'm told these charlatans have been doing it for years!

Well, you could have knocked me over with a bowlful of jelly! Up here at the North Pole we're pretty isolated, and I certainly don't get out much, especially during the Xmas rush, so this was all news to me. Anyway, the grinchers have asked me to publicize the fact that the only people helping me are Mrs. C. and my official Santa Elves and Reindeers, and anybody who tells you different is in for major legal trouble. Apparently all this criminal activity is centered near Richmond, because a

couple of the assistant V.P. grinchers said I should put it this way: "No, Virginia, they ain't no Santa Claus."

Oh, those grinchers! They basically took over the place a couple of years ago as part of the production team that made that awful movie about me. Now it's crystal clear I never should have done it, but back then, what with the world trade situation, we found ourselves in what the grinchers call a "negative cash flow position," and we needed a quick influx of cash, and—well, I sold out, that's what I did. You would have, too, if you'd seen all the projections from those spreadsheets and financial analysis packages and stuff. I was going to be a cross between Superman and E.T. The tie-ins alone would have brought our endowment back up to what the grinchers call "sound financial footing."

Of course, somehow it didn't happen. These computers are great for a lot of things, but everybody around here seems

to forget the rule about their being only as smart as the elves and grinchers who run them. So this year we're in deep reindeer manure.

NORTHERN LIGHTS Which brings me to the next depressing thought. Prepare for disappointment December 25. I'm going to be lucky to get things out in time this year. As you must realize, we've got what the grinchers call a "time-sensitive" business here. So in the interest of "efficiency," the grinchers talked me into installing one of those network things this summer. But right after the cold season started they all took vacation time and split to the Caribbean.

Then the Northern Lights came on, and our entire system went haywire, with nobody to fix it. Right in the middle of our busy season! Every time I made a list, I had to check it *three* times just to make sure the network hadn't done something naughty.

The elves finally figured out it had to do with our proximity to the magnetic pole. We had to rip the entire system out and replace it with shielded cable, and that threw our schedule way off. I hate to say this, but a lot of kids out there are likely to get a hundred feet of slightly used twisted-pair instead of that shiny new skateboard they asked for.

But who knows? Maybe their eyes will sparkle with glee. This year everybody's dead serious. Requests for cute little novelty computer items have just vanished. Chocolate terminals? Demand has melted down. Floppy-disk jewelry? DEL *.*.



■ STEPHEN MANES

Fuzzy mouse covers? Can't give 'em away. And another tradition may go down the old stocking. Our inventories are so high, some of the grinchers are demanding we use this stuff instead of coal lumps.

NO FUN But I can see why. The fun's gone out. The grinchers have taken over. In a few short years, the computer industry has managed to wring all the delight, amazement, and charm out of the little ma-

chines and turn them back into "workstations," emphasis on the first syllable. Sooner or later, they'll all be hooked up to some big computer somewhere. The only people having fun are the ones with Macintoshes, and believe me, the grinchers are getting ready to take care of them.

So what's hot on the wish lists this Xmas? (By the way, the grinchers have told me to use this abbreviated form wherever possible. Over the years, the savings in laser printer toner alone are really supposed to mount up.) Well, for one thing, there's been a minor wave of nostalgia. We've had a spurt of requests for old-style keyboards. Software that comes in a Baggie instead of a box that says "requires 640K." Sorry, kids. Can't get 'em anymore.

I have had to put the baptismal pottery division on double overtime to keep up with the demand for new fonts. But I do wish the toy companies would stop promoting products I can't bring down the chimneys before year's end. Kids ask for multitasking and protected mode and lap-top 386s and lots of exciting new software, and all I can do is tell 'em "wait till next year." If this keeps up, kids are going to start confusing me with Tommy Lasorda.

I guess I should mention one puzzling and slightly alarming minor trend among computer nerds and corporate types. As near as I can figure out, personal computers must be causing some sort of nutritional deficiency or something. When I asked, "What do you want for Xmas?" Billion Billy Gates and lots of his friends just shrugged and said "Oh, a stew." I asked if they were sure, and they said they were, so they're all going to find cans of Dinty Moore in their tube socks.

Listen, I've got to go. The grinchers are on my case about setting up some sort of poison-pill deal to keep the operation out of the hands of Borland's Philippe Kahn in case he gets grabby. As far as I'm concerned, now that he's taken to wearing a tie and charging prices in the \$495-and-up range for software, nobody's likely to mistake him for me anymore. But every time I bring up such questions, the grinchers just mutter "Ansa." Go figure.

Anyway, here's hoping your Christmas and your year will be 500K times faster than that stew. Ho, boys and girls! Ho! ☺

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COVER STORY CAROL ELLISON

POWER BEHIND A FRIENDLY FACE



hen it was released 2 years ago, *Microsoft Windows* seemed like the answer to a developer's prayer. At last! Here was a graphics interface for the PC, a friendly hand that stretched through the black hole between user and operating system to deliver the power of DOS. *Windows* erased the cryptic DOS prompt from the PC screen and opened a route around the DOS command line. It booted to a new environment that listed programs in a colorful, easy-to-read window. No longer did corporate PC coordinators have to write complex

Microsoft Windows put a graphics interface on the PC 2 years ago. Today, programs that operate in that environment have come of age—and are flexing their muscles.

It wasn't until this fall that we began to see *Windows* applications so powerful that they could clearly challenge the market leaders of the DOS world.

batch files to guide office personnel to their favorite applications. *Windows* put it all within easy reach and, at the same time, gave developers a common interface and the tools to design pull-down menus, pop-up help screens, and dialog boxes to make life even easier for users.

Microsoft reports it has shipped more than 1 million *Windows* packages since the software was released in November 1985. *Windows* was bundled with a number of applications. Over the counter, *Windows* listed for \$99, and its development kit sold for \$500—its list price today. *Windows* fired imaginations. The first application written for it, Micrografx's *In*a*Vision*, was actually on the market several months before *Windows* was released. *Windows* brought Aldus's *PageMaker*—the popular desktop publishing program written for the Macintosh—to the PC. And, in the last 2 years, other applications have appeared, including a database, a communications package, and a dictionary from Palantir Software; *Windows Paint* from Microsoft; *Windows Draw* from Micrografx, and The Whitewater Group's *Actor*, an object-oriented programming language designed to run under *Windows* (see "Windows Shopping: Applications for the Environment," *PC Magazine*, Volume 6 Number 11). Early this year *Windows Graph*, a design package from Micrografx, and *ClickStart*, a menuing utility program, were released.

But it wasn't until this fall that we began to see *Windows* applications so powerful that they could clearly challenge the market leaders of the DOS world. In October, Microsoft released *Microsoft Excel*, the DOS version of its best-selling Macintosh spreadsheet and the strongest competitor to challenge Lotus's *1-2-3* so far. On its heels came *Omnis Quartz*, Blyth Software's PC adaptation of its Macintosh database *Omnis Plus*, which combines the power of relational and hierarchical databases in a single program. These programs are bundled with a run-time version of *Windows*; some, like *Excel*, will run only under *Windows*, Version 2.0, which was also released in November.

Clearly, it's time to take the *Windows* environment seriously. All that is lacking from the *Windows* world is a high-end, corporate word processing program. *Win-*

dows Write, which Microsoft bundles with *Windows*, is a personal word processor that just doesn't fill the bill.

In this review, you'll read about *Excel*, *Quartz*, *Windows Graph*, and *ClickStart*. And this is only the beginning. *Designer*, a technical drawing program from Micrografx, was announced in September but released too late to be included in this review. Another drawing program soon to come to the PC from the Macintosh is *Illustrator* from Adobe Systems, scheduled for release early in 1988.

PICKS FOR A NEW GENERATION

These applications are truly designed for a new generation of computers. They run in graphics mode, and that means they consume RAM. Don't even think of running them with less than 640K bytes. Expanded memory is highly recommended. Even then, expect the programs to be sluggish on a standard AT. Graphics mode programs don't just move characters around the screen, they move the pixels that make up the characters, and that makes them much slower than programs that run in text mode. Microsoft chairman Bill Gates acknowledges that *Excel* moves at only about one-quarter the speed of Lotus *1-2-3* when it is scrolling up or down. But install these programs on an 80386-based machine and watch them go!

The monitor you use is also critical to the performance of *Windows*-based applications. In CGA, these programs are about as exciting as black-and-white TV, but call them up on an EGA or VGA monitor and their images spring to life. And these programs use a mouse.

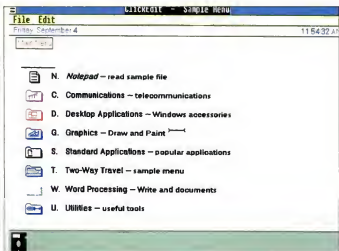
Programs like *Excel* and *Quartz* don't just make maximum use of new and powerful hardware; their efficient use depends on it. For that reason, they may not catch on until users upgrade their systems. Upgrading standard 8086 machines simply to run these applications would be a costly proposition, requiring an investment in monitors, memory boards, and turbo boards. It seems unlikely that users would be willing to bear that cost just to trade in *1-2-3* for *Excel* or *dBASE* for *Quartz*. But the *Windows* products are poised to become a powerful force in the market as users trade in their computers for 80386 machines and turn to IBM's new PS/2 family

PUTTING ON A FRIENDLY INTERFACE

ClickStart brings batch file flexibility to Microsoft Windows.

If you are eager to create your own interface for Microsoft Windows applications, you might want to investigate the new Windows add-ins from hDC Computer Corp. *ClickStart* and its companion, *ClickEdit*, sold together at a list price of \$79.95, bring to Windows what batch files accomplish in DOS. They give you the ability to create menus for Windows applications. The manufacturer is targeting the product for use in corporate workstation environments and front-end VAR turnkey systems.

ClickEdit lets you create and edit menus that either execute an application or call other menus. Each item on the menu consists of an icon that you design, a menu selection key, and a description of the application. For menus and programs, you can specify a password, enter a description of the next menu, create a help screen, and change the shape and color of the icon. For programs, you also enter information needed to find and execute the application.



ClickStart uses simple icons and descriptions to help you execute applications.

ClickEdit uses Windows features to their fullest. It uses only two pull-down menus (File and Edit), so it's hard to get lost or confused. The dialog box is well laid out, and the icon editor gives you an amusing vehicle through which you can explore Windows even if you aren't seriously interested in creating menus. *ClickEdit* uses scroll bars to adjust the icon colors and the I beam to edit text.

ClickStart is *ClickEdit* without the edit. It merely simplifies executing your applications. Each menu choice is displayed, and you select an item by clicking once on the icon. If you choose a menu icon, another menu window overlays the first. You can return to the previous menu by selecting its menu title box.

If Windows products take hold, programs like *ClickStart* could provide an attractive way of enhancing the user interface. At \$79.95 it seems overpriced, but hDC offers volume discounts that can bring the price as low as \$47, depending on the quantity ordered. That may still be more than some users will want to spend. Even without menus, many packages have names that are easily recognizable in the Windows directory, and a click or two of the mouse loads them quickly. Many shareware menu programs to load your applications are also available.

ClickStart does what it promises, but it's the kind of program you'd expect vendors to bundle free with Windows applications. —Mike Falkner



FACT FILE



ClickStart
hDC Computer Corp.
8405 165th Ave. NE
Redmond, WA 98052
(206) 885-5550
List Price: \$79.95 (in-
cluding *ClickEdit*),
plus \$3.50 shipping

and handling.

Requires: Microsoft Windows (any ver-
sion).

In Short: A menu-creation program for
Windows. Not copy protected.

Circle 667 on Reader Service Card

with OS/2.

Nevertheless, Windows' capabilities—such as Dynamic Data Exchange, which lets you run different applications in various windows and cut data from one ap-

plication and paste it into another—are strong enticements to move up from a system that can't deliver those features. The release of Microsoft Windows/386 this year and the growing user interest in multi-

tasking should only increase the appeal of Windows applications.

Carol Ellison is an associate editor of PC Magazine.

At last getting organized is painless with Nutshell Plus



In the past, when choosing a database, you had to sacrifice ease of use for power, and flexibility for programming skills.

No more.

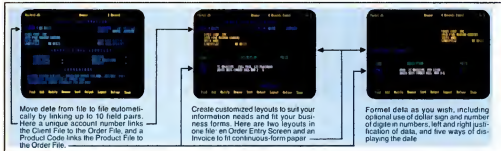
Nutshell Plus offers you the simplicity of file managers with the potency of relational technology to streamline management of your business information.

While there are relational databases with programming capability, they're not for everybody. Not everyone

wants to—or knows how to—program special routines to suit in-house needs.

What's needed is a database for the rest of us.

Imagine that instead of creating a monstrous single file of data, you can create logically linked files that pull related data from one to another, saving you time and keystroking, and preventing errors from redundant data entry. You don't have to program, but you **can** create macros.



Nutshell Plus is features-rich. With it, you can also:

- Create a form letter in a field
- Print to screen to preview the exact appearance of your data
- Insert the current date and time with one keystroke
- Change field type
- Eliminate empty space between and within records when printing
- Preset data to avoid rekeying of repetitive data
- Use the exponentiation operator in calculation

formules

- Read files you created with Nutshell, its flat-file cousin

Visit your nearest retail dealer and try the **Nutshell Plus** Guided Tour Disk, then buy **Nutshell Plus**. At \$295 we think you'll find a lot to like.

For the name of your nearest dealer carrying **Nutshell Plus**, call the Canterbury International Sales Office at 1-800-637-8385 (outside of Massachusetts) or (617) 881-7404 in state.

Nutshell Plus runs on the IBM and IBM-compatible PC, XT, AT, and PS/2s. It requires 384K and DOS 2.0 or higher. Nutshell is a registered trademark of Nashoba Systems, Inc.

CANTERBURY
International Inc.

Distributor of microcomputer hardware and software

"If understanding your business is more important than just calculating numbers... you need ."

Numbers by themselves mean nothing...

understanding your numbers and being able to communicate their significance to others can mean *everything*.

Javelin PLUS™ brings numbers to life with the best features of both a spreadsheet and an analytic database. For unequalled productivity and validity in financial

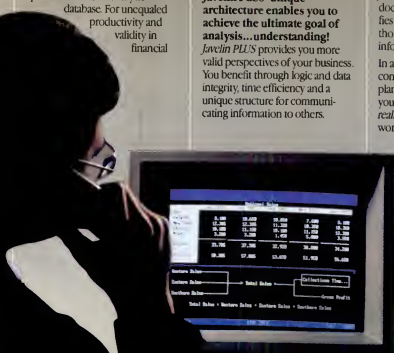
and marketing analysis, budgeting, planning, and reporting, *Javelin PLUS* helps you understand which of your business variables are most important...how they relate to each other...and helps you share the significance of these variables with other people.

Javelin PLUS' unique architecture enables you to achieve the ultimate goal of analysis...understanding!

Javelin PLUS provides you more valid perspectives of your business. You benefit through logic and data integrity, time efficiency and a unique structure for communicating information to others.

These qualities are made possible by a central information base that stores data, logic, English variable names and notes...accessed by ten views that let you review and manipulate information in whatever way is, at the moment, appropriate to your analysis. Javelin PLUS automatically self-documents your model and clarifies audit trails so you can be thoroughly confident in your information.

In a business world where your control over information and plans is critical, *Javelin PLUS* helps you understand how numbers *really* work...and how they'll work best for you.



Javelin

"If you can't afford to make mistakes... you need ."

Javelin PLUS™ brings you the best way to deal with errors... by keeping them from happening in the first place!

It's never pleasant to talk about errors. They cost money...and jobs. But the fact remains that many spreadsheets contain serious errors. Even a *Lotus* magazine article states that 30% of all spreadsheets contain difficult-to-trace flaws. *Javelin PLUS'* unique features, such as Formulas, Notes

and Errors views, are designed to avoid such pitfalls and to pinpoint errors when they occur.

For example:

- *Javelin PLUS'* clear audit trails significantly reduce the chance that logic can be lost or broken.



- Numbers, formulas, and assumption notes are dynamically linked to English variable names — not cryptically coded cell locations — so that all changes are global and rearrangements can be made easily.
- The efficiency of *Javelin PLUS* reduces total analysis time — increasing productivity. That means less chance of error caused by fatigue, and more opportunity for group discussions of computed information.

Javelin PLUS helps you manage the risks of a model's growing complexity.

Many models start out quick and dirty but soon take on larger more complex proportions. With added complexity comes frustration and errors due to the practical limitations of conventional spreadsheet software. *Javelin PLUS* solves these problems by eliminating the confusion and potential dangers of tedious cell manipulations. You can handle simple and routine tasks quickly and master the intricacies of large models...all with the confidence of *Javelin PLUS* safeguards.



Javelin

"If time is critical to you... you need



."

If there's no time like the present, why does everyone need everything yesterday? *Javelin PLUS™* does the job right the first time. Jobs that took hours or days with conventional spreadsheet software now take minutes!

Here's how Javelin PLUS saves you time...and increases productivity!

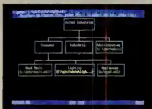
- *Javelin PLUS* lets you make as many worksheets (spreadsheets) as



you want and they are all automatically linked. You enter data only once. *Javelin PLUS'* central information base links ALL numbers,

text data, dates, relationships, graphs, notes, as well as worksheets, making manipulations easy. This permits remarkably quick report generation and lets you rearrange the layout of your worksheets without altering logic or losing information. Worksheets can be as large or as focused as you need and are flexible for anything from quick and dirty jobs to formal reports for giant models.

- *Automatic consolidations of data.* Without building new logic, *Javelin PLUS* can quickly consolidate files...and you don't need to match rows and columns!



- *Javelin PLUS understands time.* A built-in calendar handles fiscal and calendar years, and can convert data between years, quarters, months, weeks, and days. For example, your budget may be in months — *Javelin PLUS* automatically sums the data from months into quarters.

- *Interactive graphics* give you the unique ability to change your numbers by moving bars or lines. For example, you can draw a graph to create data for a forecast — the numbers go into the central information base and can be used anywhere in your model.

- *Javelin PLUS lets you use the same software for both modeling and database operations on text and dates as well as numbers.* Now you can effortlessly combine, compare, sort, and cross tab information any way you like.



When time moves more quickly than your current system for analyzing information...you need *Javelin PLUS!*



Javelin



"If you need to communicate your work to other people... you need ."

Analysis is often a group process. *Javelin PLUS™* gives you the tools to present and justify data that can be easily understood.

Automatic, clear audit trails result in easy explanation of models.

Javelin PLUS creates clear audit trails automatically. No conventional spreadsheet package provides convenient and effective documentation of logic and assumptions behind business models.



Javelin PLUS provides flexible data exchange with other Javelin PLUS users as well as with conventional spreadsheets.

Javelin PLUS allows users to import or export data, worksheets, macros, or entire models. This flexibility helps you share every-

thing you want to... or only what you want to. Libraries of models can be reliably, easily and automatically interlinked. *Javelin PLUS* understands ASCII, WKS, WK1, WRK, DIF, and SYLK data, as well as PIC and PostScript™ graphics file formats. You are in control with *Javelin PLUS*.

Javelin PLUS spans networks.

Javelin PLUS utilizes local area network (LAN) power, including Novell's® Advanced NetWare™, 3Com's® EtherShare™ and 3PLUS™, and IBM's Token Ring. Not only can you import and export data across these networks, but Javelin's SPELL key lets you look into the contents of other Javelin models and helps guide you through DOS directories and path names.

"This product is much better than I can possibly describe.

You've got to see it to believe it."

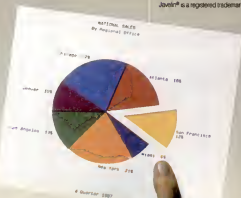
Bill Machrone
Publisher and Editor in-Chief
PC Magazine



Javelin

Javelin Software Corporation
One Kendall Square, Building 200
Cambridge, MA 02139
1-800-JAVELIN
(617) 494-1400

Javelin® is a registered trademark of Javelin Software Corp.



Javelin PLUS system requirements:
IBM PC, XT, AT, PS/2, Company, and 100% compatibles • 512K of memory • Two floppy disk drives or one hard disk (recommended) • DOS 2.1 or later version

Additional support:
IBM Multichrome, CGA, EGA, VGA graphics adapters • Hercules Graphics Card • Wide variety of printers and plotters • 8087 and 80287 math co-processors • Memory cards supporting Expanded Memory Specification (EMS) including Intel, AST, Orchid, Thyris.

REGISTERED TRADE MARKS: IBM, International Business Machines Corp., 3Com, 3Com Corp., Novell, Novell Corp., TRADE MARKS, EtherShare and 3PLUS, 3Com Corp., Novell, Advanced NetWare, Novell Corp., PostScript, Adobe Systems, Inc.

COVER STORY JARED TAYLOR

A NEW FACE FOR SPREADSHEETS



Microsoft Excel, the new spreadsheet program from Microsoft Corp., could be one of those milestone programs that change the way we use computers. Not only does *Excel* have a real chance of giving *1-2-3* its most serious competition since Lotus Development Corp. introduced that program in 1982, it could finally give the graphics interface a respectable home in the starched-shirt world of DOS.

Excel is unquestionably the most powerful PC spreadsheet you can buy. Its graphics interface is a charmer. And Microsoft has the muscle and determination

Feature for feature, *Microsoft Excel* for the PC bests Lotus's *1-2-3* on power and meets it on price—at \$495. Will this newcomer push *1-2-3* back to number two?

■ MICROSOFT EXCEL

to move markets. At \$495, *Excel's* list price is the same as that 1-2-3's. If *Excel* fails, it will be because 1-2-3 is so deeply dug in nobody can bounce it out—and because not enough people are willing to buy the hardware it takes to run *Excel*.

Microsoft clearly had its finger on the pulse of PC technology when it developed *Excel*. The program glitters when run on new, fast, powerful systems. But users who run it on anything less than an 80386 may consider *Excel's* reliance on state-of-the-art hardware a liability. *Excel* will run on an AT but, being a graphics-based program, it's slower than other spreadsheets. It will work on a regular CGA monitor, but you can't really appreciate its fine use of color without EGA. And *Excel* consumes so much RAM, that you'll need expanded memory to run models bigger than 180 bytes. *Excel's* future is really linked to how quickly users become enamored of and ready to invest in the newer, more powerful systems.

FLASHY LOOKS For people who cut their teeth on 1-2-3 and have never played with a Mac, *Excel* looks more like a video game than a serious spreadsheet. It comes with a run-time version of *Microsoft Windows*, so it has cheery colors, scroll bars, icons, and menu bars. But users will soon discover the beauty of *Windows*. Since it treats the whole screen as graphics, you can have different spreadsheets and charts in different parts of the screen and you can change nearly everything about the way anything looks.



FACT FILE

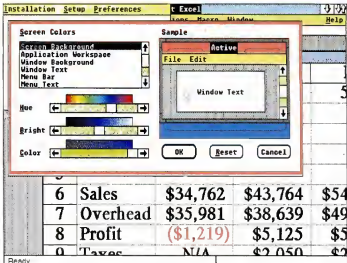
Microsoft Excel

Microsoft Corp.
16011 NE 36th Way
Redmond, WA 98073-9717
(206) 882-8080
List Price: \$495

Requires: AT or 386-based PC, 640K RAM, hard disk, color/graphics monitor, DOS 3.0 or later, EGA, expanded memory, and mouse recommended.

In Short: A powerful, full-featured, graphics-interface spreadsheet that should seriously threaten 1-2-3. Not copy protected.

CIRCLE 666 ON READER SERVICE CARD



Behind the Microsoft Excel control panel that lets you choose screen colors is a spreadsheet that illustrates your ability to adjust the height or rows and show cell contents in color.

If you want to draw attention to a number, you can write it in boldface, italics, or large type. You can change its color or font style, underline it, put a shaded background behind it, or draw a border around it. You can make *Excel* display negative numbers and zeros in special colors. You can adjust column widths and row heights in extremely small degrees. If you like, you can turn off the whole row-and-column grid or paint it any of eight different colors. You can even change the colors of menu bars, window borders, and scroll bars. And if you think all that graphics interface paraphernalia clutters the screen, you can get rid of most of it.

You perform most of this magic by choosing items from Mac-style pull-down menus and dialog boxes. This is the interface the mouse was made for, but you can use *Excel* without a mouse. There are plenty of shortcut keyboard commands, either to open menus or to go straight to the choice you want. *Excel* uses all the function keys for this—in combination with both the Shift key and Ctrl-Shift—as well as obscure combinations like Ctrl-Shift-Spacebar. Even veteran mouse users will find some of these combination key com-

mands handy, though they won't have to learn as many of them.

ESSENTIAL FUNCTIONS *Excel* is stuffed with features. It has 131 built-in functions—41 more than 1-2-3—including little gems like *fact()*, which gives the factorial of a reference, and *product()*, which multiplies all references by each other. If these 131 aren't enough, you can design your own functions by writing special macros. In all cases, when you need to enter a function, you can call up a list of them, in alphabetical order, and paste them right into the spreadsheet. You simply click the mouse on the edit menu to bring up the selection of Paste functions available to you. Click on the one you want and the function appears in the edit line of the spreadsheet. This is a handy feature that both reminds you of proper syntax and eliminates typos.

Display formats are just as versatile. *Excel* gives you 21 standard formats and lets you design more. Telephone format, for example, might add parentheses, spaces, and hyphens, while you entered only numbers. Lira format (or US Budget format) could throw away the last nine dig-

its and display all numbers in billions. You can choose any characters, in any color, as prefixes or suffixes to numbers. To design your own display formats, you can either edit a standard format line or write a string to indicate an entirely new format.

A wonderful gift to the user is the Undo command. This feature alone is practically worth the purchase price. A related command saves time by repeating the most recent command.

Other nice touches make it easy to build spreadsheets. If you want to enter the same or similar formulas in every cell within a group, you can do it at a single stroke. Highlight the cells, write the formula, and hit Ctrl-Enter instead of Enter. Relative references are adjusted and absolute references stay absolute. The Copy command also comes with nifty options. You can add the source range to the destination range (or subtract, multiply, or divide) or copy only values or formats.

Still another excellent feature lets you edit long cell entries in their entirety. Most other spreadsheets force a string off one edge of the screen if it gets longer than a single line. In *Excel*, the editing window automatically grows, one row at a time, to hold giant formulas.

Cell naming is especially well done. If you have data with labels down the left column and along the top row, you can highlight the whole matrix and name every cell in it. Each cell at an intersection of a column and row gets a unique name, such as March Expenses. You can use these names in formulas and, as with functions, when you need them you can paste them into your spreadsheet from a list.

Excel can build little databases almost exactly the same way *1-2-3* does, with records strung out in single rows. You manipulate them with criteria ranges, extract ranges, sort keys, and so on. A handy advance over *1-2-3*, though, lets you enter data into pop-up windows that look like labeled forms so that you don't have to type in new records row by row.

For sophisticated applications, *Excel* gives you array math. This means that with a single formula you can multiply one group of cells by another group of cells and add up the results. In other spreadsheets, an operation like this would take a great many different formulas.



Excel versus 1-2-3: Summary of Features



SPREADSHEET CAPABILITIES		
256 x 16,384	Max. work area: columns x rows	256 x 8,192
●	Uses 80287	●
●	Can vary row height	○
●	Hides rows	○
●	Hides columns	●
Many	No. of split screens	2
●	Merges contents	●
●	Links spreadsheets	○
●	Calls user-written programs	○
FUNCTIONS OR FEATURES		
●	Undo	○
131	No. of functions	89
●	Customizes functions	○
7	Formulas error values	1
●	Performs minimal recalc	○
●	Compares results	○
CELL CONTROL		
240	Max. no. of characters per cell	240
●	Cell protection	●
●	Ability to hide contents	●
●	Cell annotation	○
●	Track dependencies	○
MACRO LANGUAGE		
355	No. of statements	42
●	Learn mode	○
●	Runs 1-2-3 macros	●
ON-SCREEN CONTROLS		
●	Can display graphs with spreadsheets	○
●	Displays colors and fonts	○
●	Prints from screen	○
●	Offers print preview mode	○
OTHER		
7	No. of graph types	5
●	Supports mouse	○

●—Yes ○—No

How rewrote a

First we wrote a wish list. With help from the 500,000+ people who've already chosen MultiMate® for word processing.

We also had help from a whole new generation of users. Professionals and managers who want quick results from the software they use.

We Gave It A Hot Start And Finish.

The result is MultiMate Advantage II.™



menus. There's also a Hot Print feature that prints out memos at the touch of a key.

Which all adds up to a fast start and an equally fast finish.

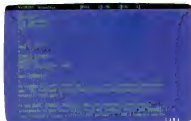
**We Let You Directly Merge
With Another Bestseller:
dBASE.**

We've made it easier than ever to merge directly with dBASE® files. So you can generate loads of personalized form letters. And preview them on-screen with the dBASE data in place.

You can even import ASCII files directly, or use file conversions with other popular software.

MultiMate also supports over 400 printers, including the latest lasers.

Your choice of fonts has increased as well. Now up to 26 fonts in



A few simple commands let you directly merge dBASE files without leaving MultiMate. And without knowing how to work dBASE. Which makes it easy to create stacks of personalized form letters.

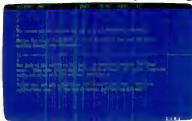


we bestseller.

a single document, with 18 downloadable.

We Made It Easy To Read.

Understanding and learning
MultiMate is easy when you use the



Now you can access the power of MultiMate with simple pull-down menus (left) or choose the original interface (right).

Both interfaces have document mode for visible page breaks and fast scrolling
new optional pull-down menus. So is
day-to-day operation.

But maybe you're familiar with the
original MultiMate interface. Never
fear. It's still there, with
all the power you need to
tackle the toughest word
processing jobs.

Whichever interface
you choose, you now get
fast page-to-page scrolling
with visible page breaks.
Plus search and replace is
15 times faster and lets you
go forward or backward.

We've also added a sorting capability
that many are calling the best in the
business. And an undo-delete feature
that lets you bring back the passages

you thought you
didn't want.

Finally, when
you're ready to print,
our new Preview
mode shows how
your pages will look.

With headers, footers

and footnotes all in place. All of which
gives you total flexibility. So you can
tackle simple jobs simply. Right off the
bat. And still handle the big jobs.

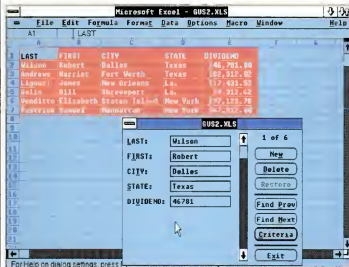
For the name of your
nearest authorized
Ashton-Tate dealer, or for
more information about
corporate training, call
(800) 437-4329, Ext 231*.

And learn how a good
rewrite can improve even
the best of bestsellers.

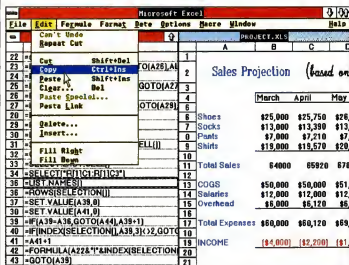


ASHTON-TATE*

MICROSOFT EXCEL



When you define a range as a database, Excel automatically uses column headings as field names in the database. The contents of the cells become the entries.



The edit menu is displayed in this Excel screen, which shows a spreadsheet in the right window and macro script in the left one.

If you need to do consolidations, Excel lets you write formulas that refer to cells in other spreadsheets. A nasty kink in this

feature, though, is that if a formula refers to more than one external spreadsheet, all the spreadsheets have to be in memory.

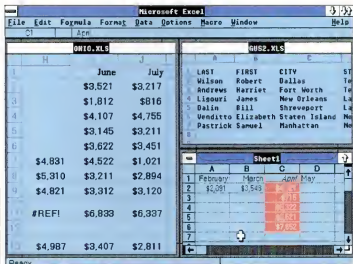
You'd usually want to do consolidations only because you had a lot of different spreadsheets. Unless you had loads of expanded memory, your roll-up model might not fit in RAM.

If you do have huge spreadsheets, though, Excel takes the agony out of lengthy recalculations. Instead of stupidly grinding its way through the whole sheet recalculating everything, Excel updates only formulas affected by the latest changes. Just as helpfully, Excel doesn't freeze your machine while it's recalculating; start typing and you're back in control. Excel starts recalculating again once you're finished.

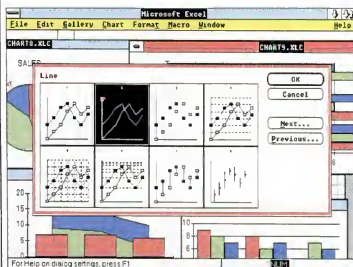
AUDITING TOOLS Excel gives you a whole bagful of tricks to keep bugs out of your spreadsheets. For example, you can attach notes to any cell, explaining the reasoning behind a value or formula—a feature that you can add to 1-2-3 by buying one of the cell notation add-in products on the market (See "Scratch Pads and Annotators: TSR Notes to Yourself.") Another wonderful feature lets you find all the cells that depend on a particular reference, or all the cells the reference depends on. You can get a list by cell address, or if you like, Excel will highlight cells right in your worksheet. If you find you've made a consistent reference error, you can fix every occurrence at a stroke by using the search-and-replace command, which works on formulas as well as labels.

Another great troubleshooting technique lets you pick a range of cells and highlight, say, all the formulas, or constants, labels, logical statements, or error cells. This is a quick way to see whether a label or a constant has sneaked into a block of cells that is supposed to be all formulas. Even better, you can check for formulas that don't fit a pattern. If a whole range is supposed to multiply the cell to the right by the cell above it, you can instantly spot an oddball that doesn't. This is a marvelous way to check for consistency.

With all these auditing techniques, if you ask Excel to highlight offending cells, you may want to see more of the worksheet than usual. Excel has a preview feature, which lets you squeeze your spreadsheet down to tiny type that is 4, 5, or 6 points in size, instead of the usual 8- to 25-point size



Excel makes it easy to transfer data. Here we cut a range from the spreadsheet on the left of the screen and pasted it into the spreadsheet on the lower right.



The preformatted line chart type in reverse video has been selected as the format for the active chart. In the background are different Excel charts, all displaying the same data.

time. You can still make use of all of the normal spreadsheet functions in this bird's-eye view, which allows you to examine the

overall structure of your spreadsheet.

Even if you're not thinking about audits or maintainability while you build your model, you can use the Apply Names command to make things much easier for anyone who comes later. By giving the key values in your worksheet useful names like `back_orders` or `tax_rate`, you can force every formula in your model to display names rather than cell references, making your logic much clearer.

The Precision as Displayed option is another great way to reduce errors. It ensures that if you format your data with two decimal places, that is the value Excel stores internally—not some 12-decimal-place monstrosity. This means you never have rounding errors or tables that won't cross-foot.

If you do make mistakes, Excel has eight different cell error messages to tell you what you did wrong. #DIV/0 obviously means you tried to divide by zero, and #NAME? means you used a range name that Excel hasn't heard of.

GRAPHING AND PRINTING True to its graphics orientation, Excel lets you draw lovely charts and graphs. It gives you seven basic types, such as bar, line, and pie, and 44 different variants on these basic types. You can pick these different formats from a charting gallery, just as you choose commands from a menu. You can adjust colors, patterns, labels, and chart titles. If you want to emphasize a value, you can even draw an arrow to it.

But the best thing about Excel graphs is their intelligence. If you highlight a data matrix, with labels across the top and down the left-hand column, Excel understands that the numbers should be data points and that the labels should run along the two axes of the graph. Excel saves you time by arranging all this information the way you would arrange it yourself. You can then add graph titles and other text in the colors and fonts of your choice. If you want to examine a graph while you work on the spreadsheet that contains the data, you can squeeze the graph off in a window at the corner of the screen where it will re-scale and redraw itself. As the data change, the graph changes.

Excel drives most common printers and plotters, and gives you the usual options of

CARE TO CUSTOMIZE?

From its file structure to its macro language, Microsoft Excel is a powerful developer's tool.

One very important reason for the PC's success was open architecture. By building a modular computer with an expansion bus, IBM made it easy for people to plug in their own hardware. This gave the machine tremendous flexibility and took it in directions IBM never thought of.

Microsoft has tried to design *Microsoft Excel* the same way. From its file structure to its macro language to its interprogram communications protocol, *Excel* was built to be customized. Microsoft has tried to give independent developers the tools to take *Excel* in as many directions as they took the IBM PC.

An enormous amount of development work can be done with the macro language alone. Custom menus and dialog boxes are obvious, flashy ways to make it easier to build models that someone else is going to run. The big headache in applications development, though, is anticipating all the crazy things a complete stranger—the user—might do. A good application has to be ready for anything, and *Excel* gives you many ways to cope with user craziness.

One is a whole series of reconnaissance functions that tell you what's happening in the worksheet. You can find

out a document's name, what directory it came from, whether it's protected, what kind of charts it contains, how many columns and rows it uses, its recalc mode, and more. Perhaps most important for developers, you can check if anything has happened to the worksheet since it was last saved. You can get equally detailed information about individual cells: whether they're values or labels, underlined, boldface, hidden, centered, and so forth.

This information means your macros don't have to run blind, hoping and praying that the user will do the right thing. You can check on what he did before and branch accordingly.

If you write in C or FORTRAN, you can use the Register and Call macro commands to run your own programs. If, for example, you had written a routine to do Fourier transformation or to generate Mandelbrot patterns, you could call it from within *Excel* with a macro. Register and Call can be dangerous. Since you are actually adding them to *Excel*'s internal command stack, if you don't use them right, they can run wild and blow up your application.

If you are building an application to run under *Microsoft Windows*, Version

2.0, you can use dynamic data exchange (DDE). Think of DDE as a software bus, analogous to the PC's expansion bus. It's a channel for linking different programs and making them work together. Since *Excel* can take DDE instructions as well as give them, you can make *Excel* just a small part of a larger application. You could use it as the calculation engine for a financial analysis or database program and run it automatically only when necessary. It would pass results back to the main program via DDE. DDE is custom integration: you get the benefits of integration without being locked into modules you didn't choose.

Finally, even at the unglamorous level of file structure, *Excel* has kept its architecture open. Its files are in binary form and as machine independent as possible. Files from one environment are meant to work in any other. Version 2 of *Excel* for the Macintosh, for example, will use the same file format. The file specification is public, so you can start work right now on utilities that manipulate *Excel* data.

Excel comes with all the tools you need to turn out custom applications slick enough to slide uphill. Now all it needs is a user base. —Jared Taylor

specifying headers and footers, page breaks, titles, and the number of copies. One of its slickest features lets you preview a print job if you're not sure what it's going to look like on paper. You get a screen image of the printed page in tiny, unreadable type, but you can pick a spot and zoom in on it if you need to check the text.

If you have the right hardware, you can print a spreadsheet with just as much color and style as *Excel* can use to display it. With a laser printer and the right font cartridges, you can build a spreadsheet that not only figures your taxes, but prints out a

perfect copy of a 1040 form, complete with lines, fine print, and shading.

MACROS AND MORE All the power of *Excel* is at the disposal of what is clearly the most sophisticated spreadsheet macro language available. Macros stay in separate macro worksheets, which means you can use the same macros on any number of different models or even on a series of models in succession. While they're running, you can hide macro sheets or reduce them to icons to keep your programs secure.

For automating simple, repetitive jobs,

you can record keystrokes and mouse clicks directly as macro script. For complex programming, you can use any of an astonishing 355 commands and statements. Macros can be set to run at particular times, when you open or close a file, or when certain data change. They can tell whether a model has been changed since it was last saved and what subdirectory it came from. You can even write macros that remap the entire keyboard to the characters—or macro routines—of your choice.

If you build custom applications, you can write macros to build menus, help

screens, and dialog boxes that are just as powerful as those that come with the program. Even when your applications use *Excel's* native menus, if there are certain commands you don't want users messing with, you can take them right out of the menus. For virtually bombproof applications, you can build models that accept data *only* from dialog boxes.

■ At the very least, *Excel* should put the fear of God into Lotus Development Corp.

The macro language is also your gateway to interprogram communication. With *Excel* running under *Microsoft Windows*, Version 2.0, macros can load other *Windows* programs and send command sequences to them. At an even deeper level, *Excel* can establish two-way communications links with compatible *Windows* programs, in a procedure called dynamic data exchange (DDE). With DDE links, *Excel* can act either as a client or as a server. Each program has access to the others' command primitives and can share memory objects.

As an example of DDE, you could write a macro that tells *Excel* to load a communications program at a certain time of day. *Excel* would then tell the comm program to dial up an on-line stock quote system and feed updated quotes to *Excel*. At certain price points, *Excel* could tell the comm program to dial a broker and place an order. DDE is likely to be at the heart of many multitasking applications running under OS/2.

Finally, in a feature strictly for programmers, the macro language has commands that let you run FORTRAN and C routines you have written yourself. You can also use these commands to call routines from the *Windows* library.

HELP, MANUALS, AND TUTORIALS
For users who are not going to write their own C routines, *Excel* has the most thor-

ough set of help screens, manuals, and tutorials I have ever seen. There is an on-line manual that gives information on any topic, as well as context-sensitive help. You can turn the mouse pointer into a question mark, move it onto anything on the screen, and get help on that. There are even special help screens for 1-2-3 users. If you know how to do something in 1-2-3, the program tells you how to do it in *Excel*.

Excel's on-line tutorial and reference manuals are excellent. The tutorial gently coaxes you through realistic *Excel* sessions, and the manuals are clear and well organized.

INSTANT HIT? What could keep *Excel* from becoming an instant hit? Two things. The first is *Excel's* hunger for hardware. Graphics-based programs are naturally slower than character-based programs, so *Excel* is a sloth on a regular 8088-based PC. It runs all right on an AT but doesn't really get frisky unless you move up to an 80386. Even then, it doesn't have 1-2-3's satisfying snap. Also, though you can run *Excel* with a regular CGA monitor, anything less than an EGA is ugly. Finally, *Excel* is a RAM hog; you'll need expanded memory to run models bigger than 180K.

Feature for feature, *Excel* is far better than 1-2-3. *Excel* can read 1-2-3 worksheets and translate 1-2-3 macros. Its special help for 1-2-3 users should make it easy to make the switch. Even so, many Lotus jockeys would rather fight than switch—and many of them have 4.77-MHz mono PCs that couldn't run *Excel* anyway. Besides, Lotus is working on Release 3.0 of 1-2-3 right now. Though it won't be graphics based, Lotus has time to copy some of *Excel's* best features.

All the same, *Excel* is just too good not to have a fighting chance. At the very least, it should put the fear of God into Lotus Development Corp., and we'll all benefit from that. And once people realize there are alternatives to 1-2-3, they might consider some of the other fine programs now available. (See "Challenging 1-2-3 on Price and Power," *PC Magazine*, Volume 6 Number 18.) Spreadsheets have been a one-product market for too long. ☐

Jared Taylor is West Coast editor of PC Magazine.

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COVER STORY MIKE FALKNER

CROSSING THE GREAT DIVIDE

W

ith the introduction of *Omnis Quartz*, a new database package that runs under *Microsoft Windows*, Blyth Software joins a small but rapidly growing group of software developers that have brought their Macintosh products to the IBM PC. Founded in 1982, Blyth Software introduced its first product, *Omnis 3* for the Mac, in England and brought it to the United States in 1984. *Quartz*, patterned after *Omnis 3 Plus* (the latest Macintosh version), comes to the DOS world with more functions and features than *Omnis 3 Plus* currently has on the Mac.

It was *Omnis* on the Mac. Now Blyth Software brings its database package to you—through *Windows*—as *Omnis Quartz* on the PC.

■ OMNIS QUARTZ

You install *Quartz* in a subdirectory. As with most *Windows* products, any command can be accessed by using a mouse. And you don't have to deal with screen and printer definitions since those are supplied by *Windows*.

Quartz is large. Its main module and an overlay module will consume almost 500K bytes of your disk. You must run *SHARE*, a DOS 3.x program that allocates memory for file sharing, before *Quartz* will execute. You can then start *Quartz* in *Windows* by typing the command WIN QUARTZ or by double-clicking the mouse on QUARTZ.EXE.

The screen will look familiar to anyone who's seen *Omni* on the Mac. There are menu choices for File, Edit, and Options. You can add new menu choices as needed to change layouts and reorganize files.

Quartz holds everything associated with a given application—files, screens, and reports—in two files. One ends with a .QD1 extension and contains data for all the files in an application, and the other ends with .QAP and holds all the formats. An application called SALES, for example, would have a file called SALES.QAP where screens and report formats for customers, invoices, and inventory items are stored. Another file, SALES.QD1, would contain the actual customer, invoice, and inventory information.

HIERARCHICAL VS. RELATIONAL

Quartz is a hybrid—a cross between a hierarchical database and a relational database. In a hierarchical database, data in one file is related to data in other files through a series of pointers. Information isn't duplicated. This saves file space and speeds up data retrieval, but also makes it difficult to reconstruct a file that becomes corrupted; you may have to read many records to find the last data item in a series. In a relational database, such as Ashton-Tate's *dBASE III*, data that relate two or more files are stored in each file. This increases the size of the file and, often, the time it takes to retrieve records. Because they are recorded twice, however, the relationships among the data are often easier to maintain and re-create.

Quartz establishes the connections by assigning an internal record sequencing number (RSN) to every record in a data-

 **FACT FILE**

Omni Quartz, Version 1.0
Blyth Software Inc.
1065 E. Hillside Blvd., #300
Foster City, CA 94404
(800) 843-8615
(800) 223-8050 (in Calif.)
(415) 571-0222
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EGA or CGA graphics monitor and display
card, DOS 3.2 or later. Mouse recommend-
ed. *Windows* run-time module is included
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that takes full advantage of the capabilities of
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base. When another file is connected to that database, each record will contain the RSN of the item it relates to. In effect, *Quartz* stores pointers in the fashion of a hierarchical database, speeding up retrieval times. But like a relational database, it also stores a common data item, the RSN, in each record. This increases the file size a bit, but not as much as if *Quartz* duplicated data.

When you first load *Quartz*, you're presented with a window showing all the available applications. You must select one from the list or devise one through the Create New Application option. This creates a new application file where you can begin building your database with any of five *Quartz* formats: File Format, which describes the data fields for each file in the application; Layout Format, which defines the appearance and characteristics of the screen through which you'll enter data; Report Format, which defines the reports you want; Search Format, which allows you to limit the records that you will print in the report; and Menu Format, which helps you to customize your application with your own menus.

TAB TO ENTER You can use either the keyboard or mouse commands to move around the format screens. You can click the mouse on each question or use the Tab key to move from section to section choos-

ing your options. The *Windows* I beam is used to add and edit information, and there are shortcut keys for many of the pull-down menu choices. Instead of using the Return key to enter data, *Quartz* uses the Tab key. Return is used only when you've finished with the data and want to write it all into a buffer. This is a convention used in all *Windows* products, but we found it annoying. The Return key is the convention used to enter data in most other software on the market; by now, users are conditioned to it.

FORMATTING FILES You need to create a file format before you create screens and reports and actually start the application. After you select File Format in the Options menu, *Quartz* opens a window where you select a file to edit—or you can choose New to create one in another window, where you would enter a format name of up to eight characters. When you finish, you are taken to a File Format field definition screen, where you can add up to 120 fields. Hitting the Tab key takes you to an area below the definitions, where you enter a field name of up to 15 alphanumeric characters. Another Tab takes you to the Field Type area, where you define the field as either text, numbers, Boolean (yes-or-no) entry, date, time, or a record-sequencing number. Tab again and you get to an Index Box, where you can sort fields. Finally, you enter a number to define the field length and hit Return to finish the definition.

Then you select the Save Changes option or Ctrl-S in your Amend menu, but *Quartz* will not actually save the changes until you leave the application or exit *Quartz*. If you've made an error in a definition, you can select Undo Changes from the menu and the last format saved will replace the current one.

If you need to relate two or more files, you must do this before you add information; otherwise, the information you enter prior to establishing the relationship won't be linked. To establish the relationship, you first add a sequence field in your database to hold the RSN. Next, you select Set Connections in the Amend File menu, and *Quartz* displays the other files in the application. Then you select a file to connect and hit Return, which marks the file with

an asterisk. A click on OK establishes the connection.

DESIGNER LAYOUTS Quartz gives you no automatic screen displays, so you must create a layout format before you continue. You do this by selecting Layouts at the Options menu. A window appears listing all existing layout options. As with the file formats, you can edit an existing layout or select New and enter a layout name; this, like all other format names, is limited to eight characters. Quartz won't let you reuse a format name, so Blyth suggests using *F* for files (FWIDGETS), *L* for layout (LWIDGETS), *R* for reports (RWIDGETS), and so on. The idea isn't bad for small applications, but it can be confusing in a larger application where you have 12 reports, for instance, that you have to name RSLSDEPT (sales by department), RSLSDPSM (sales by department and salesman), and RSRGDPSM (sales by region, department, and salesman). The eight-character restriction limits its flexibility. Quartz should let you enter descriptive names so that each application is easier for the user to understand.

The layout format is simple to design. Your current cursor position is indicated by both a rectangular cursor in the format window and a small window at the bottom of the screen. To place text, you click on its intended screen position and start entering information. If you double-click at the position, Quartz opens a field definition window and you define the position as a data entry field. Once a text item or a field has been defined, you can move it by using Ctrl click-and-hold on the left side of the field. To increase the size of the field or text, use Ctrl click-and-hold to stretch the right side of the field. You can also select an area on the screen and have Quartz draw a rectangle around it.

A Quartz entry field accepts data, and you can give it attributes such as uppercase only, no negatives, unique index, blank when zero, and display in a color.

A display field only displays information; it can't be edited. A check-box field is used to ask yes/no and true/false questions; Quartz displays a square box where an X can be inserted by hitting the Spacebar or clicking the mouse. You can also choose from Radio Buttons or Push Buttons. A

The screenshot shows the Quartz application window titled "Onnis Quartz". The menu bar includes File, Edit, Options, Amend, file, format. Below the menu bar is a table titled "file format FPERSON".

		file format FPERSON	
1	SOC_SEC_NUM	Character	12 IND Social Security Number
2	FIRST_NAME	Character	15
3	LAST_NAME	Character	20 IND
4	ADDRESS	Character	50 Street & city address
5	STATE	Character	2
6	ZIP_CODE	Character	5
7	BUSI_PHONE	Character	14 Business Phone Number
8	EXTENSION	Character	5 Telephone extension
9	HOMI_PHONE	Character	14 Home phone number
10	SALUTATION	Character	1 Form of address

Below the table, a field definition window is open for "SOC_SEC_NUM".

1 :SOC_SEC_NUM Description:Social Security Number

-field type:

☒ Character ☐ Boolean ☐ Time ☐ Sequence ☐ Indexed

Field length: 12

Index length: 12

Quartz gives you a field definition window to help you define entry fields. The field definitions are shown at the top while field names, field types, and field length are entered below.

Radio Button (the Windows name for a circle on the screen that changes to black when you select it) is used when you want many options displayed on the screen with only one choice permitted. Push Buttons, another Windows name, each execute a series of predefined commands such as Insert, Edit, and Delete, or any other series you attach to them. List Fields lets you define your own window, where you can scroll through different items in your database. By clicking on one of the lines in the list, you can instruct Quartz to display the detail of that record.

Each layout can have up to 12 screens associated with it. The PgUp and PgDn keys move you from one to another, and the Windows List command in the Amend Layouts menu moves you quickly to a specific screen. You can position your layout windows anywhere on the screen and adjust the window size to fit the needs of the application. Again the Tab key moves you from question to question, and you can select and edit fields with the mouse pointer and the I beam.

After all that work, you are finally ready to enter information. Once you have taken the time to set up the screens, Quartz

does produce attractive formats, but it provides no automatic screens for users who wish to short-cut that step.

To enter data, you first select the Data menu and choose Set Main File so that Quartz knows where the data should be saved. You select a screen layout from the Options menu and the entry fields become active. Each addition or change to the database must be initiated with a command from the Data menu, such as Insert, Edit, and Delete, or with the shortcut keys (Ctrl-I, Ctrl-E, and Ctrl-D).

The Tab key moves you from field to field as it did in the format definition screens. You store the information by hitting a Return anywhere on the screen, and if you accidentally use Return too early, you must issue an Edit command to complete the record. Once you've found a record, you can use commands in the Data menu to display the previous and the next record in the database.

CONSTRUCTING REPORTS Reports are easy to develop using the report format window. From the Options menu you select Reports, and all existing reports are displayed in a window. A click on New creates



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■ OMNIS QUARTZ

Report formats are defined in sections. The Heading section defines the top of each page on the report, and the Detail section defines up to 240 lines to print per record.

a new format, and you are presented with a blank window for defining reports.

Each report is divided into sections where you define text and data fields for printing. The first section, Heading, starts the report with the information that will appear at the top of every page. To indicate the type of section you want, you place your cursor at the top of the page and select Section from the Amend Reports menu. You can also use the F3 function key as a shortcut. Quartz places a horizontal bar labeled "Heading section" to indicate the beginning of the heading definition. You can then enter column headings on the lines below it and supplement them with the built-in date and page number functions in Quartz.

Following the Heading section is usually a Detail section, where you can enter text or place data in any column on the page. From there you can access a field definition window, where you can enter a field to print or a calculation to perform and print. The Detail section can contain multiple lines of text and data from any file in the application as long as the file is related to the main file you selected. Detail sections can also contain up to nine Subtotal

sections, which can be followed by one Total section. You must designate a section called End of Report to complete the definition. You can print the report by selecting Print from the Amend Reports menu or by choosing Reports in the Options menu.

Now that you've created the basic application, you can access all the screens and reports from the Options menu. But if you do not wish to use all your data in the reports, Quartz will let you define up to 50 limits so that only the records that match the criteria you set are printed.

COOK UP A MENU The last and most powerful of the formats in Quartz is its Menu format, which lets you create your own pull-down menus to execute any menu function in the program. It also lets you test conditions, call subroutines, and build a completely menu-driven application. Although there are over 180 commands in Quartz, they are easy to understand and no more difficult to use than the command languages of other databases.

Even though the final Quartz documentation was not complete at the time of this writing, what was available ranks among

the best we've seen. The tutorial, called "Learning Quartz," was outstanding.

The documentation contains two other sections: "Applying Quartz," a continuation of the tutorial that helps you understand how to create applications, and the reference manual, a detailed description of commands, functions, and capabilities. Many examples and diagrams describe Quartz features and functions.

Quartz allows you to import and export files using DIF, SYLK, dBASE, I-2-3, delimited ASCII, and one-field-per-line formats. Blyth also plans to retrofit the Omnis 3 data files to make them compatible with Quartz in 1988. Quartz is a superset of Omnis 3, adding flexibility in the way you can define file formats, layouts, and reports, and Blyth intends to upgrade Omnis to match the new features in Quartz.

DEVELOPERS TOOL Quartz was designed as an application developer's database. You can have over 60 files open in any application, with up to 12 menu items on the menu bar, each with up to 20 functions. Layout and report formats can contain information from any files that have been related, and you can have up to nine levels of passwords with record and file locking if you're using the system on a local area network. The setup and organization of the application, though, can be difficult because of the power of the formats.

Quartz is not a head-on competitor of dBASE III, R-base, or other databases, and Blyth is not marketing it as one. Instead, Blyth is aiming at the applications developer who can take the time to define an application. dBASE III is great for quick and functional databases, screens, and reports, and it doesn't require the level of effort Quartz demands. On sophisticated applications, however, dBASE III can't often match Quartz's ability to create screens, print reports, and relate files. And Quartz's Windows interface is sophisticated in its use of pull-down menus. Quartz won't likely replace a dBASE III, but it does bring the friendly interface of the Macintosh to the PC and gives us a glimpse of how applications should be written under OS/2.

Mike Falkner is a microcomputer consultant based in Sacramento, California.

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OPENING UP WINDOWS GRAPH



f Microsoft *Windows* is to be taken as a serious tool—rather than just a cute and colorful interface that absolves programmers of the need to write video and printer drivers—you need one of every major kind of program running under *Windows*. Preferably stellar examples of every kind of program.

Windows Graph, a \$395 wonder from Micrografx, represents the presentation graphics component of the *Windows*-gets-serious equation. With *Microsoft Excel* and Blyth Software's *Omnis Quartz*, *Windows* now offers world-class graph-

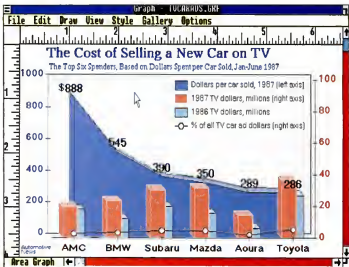
This flexible, robust program is complex, but it rates among the best graphics packages on the market for skilled users willing to learn the ins and outs.

■ WINDOWS GRAPH

ics, spreadsheet, and database programs, but still needs a killer word processor on a par with *Microsoft Word* or *WordPerfect*.

Why is *Graph* so good? Partly, it's the family heritage. Every *Windows* program has access to all the fonts available in laser printers, so a chart worked up in *Graph* and printed on an HP LaserJet can have crisp Helvetica and Times Roman legends and titles. Most other graphics packages generate their own chicken-scratch fonts internally, ignoring your laser printer's capabilities (although more and more packages, such as *Microsoft Chart* or *Lotus's Graphwriter II*, now talk PostScript). Also, *Windows Graph* can clip and paste text and graphics among *Windows*-compatible programs and can get live updates of data from other programs via *Windows'* dynamic data exchange (DDE). You could pull in stock market quotes through a communications program and watch the graph change with the market. On a less esoteric level, you could set up a graph exactly as you want it with one set of data, perhaps this month's sales figures, then point to a different data file (next month's sales) and create the new graph without doing any of the work of setting up a graph from scratch.

The other part of *Graph's* appeal is



Micrograph's \$395 *Windows Graph* lets you overlay multiple graphs, then stretch them to the desired size. Here, an area chart provides the backdrop for column and line graphs. Though you can fine-tune the graph precisely, some features are still missing, especially the ability to add dollar signs and commas to the axes.

Graph itself. In two words, it's robust and flexible. You can overlay multiple graphs; place several graphs on a page; stretch-fit graphs left-right, up-down, or proportionally; add clip art if you feel the need for a prancing stallion in the upper-left-hand corner; and enhance the graph with the built-in drawing/paint tools. How good is *Graph*? It's a professional-caliber tool: most any of the colorful *USA Today* minifacts graphics ("We're Buying More Christmas Stamps") could be replicated in *Graph*.

COMPLEX COMMANDS If *Windows Graph* has a weakness, it lies in the kind of complexity that rewards day-in, day-out users willing to commit *Graph's* commands to memory—and that punishes once-a-week or once-a-month users who find themselves hunting for commands they learned and then forgot in the interim. Some users may find *Harvard Graphics* a bit easier to use and possibly more powerful than *Graph* (if you can't make the program do your bidding, you can't get much done), and for workmanlike hands-off pro-

duction of multiple graphs using changing data, nothing beats *Lotus's* new \$495 *Graphwriter II*. With *Graphwriter*, you can type a one-line command from DOS to run a script that locates your latest data files and prints a dozen graphs unattended while you're having lunch.

Graph shares with every *Windows* product the inability to be taken seriously on an 8088/8086 PC. Bill Gates gets tired of the criticism, but a lot of users are getting tired of having to trade off speed for *Windows'* graphical interface. *Windows* only begins to be acceptable on an 8-MHz AT, and Compaq's 20-MHz Deskpro 386-20 is more what you'd like to have as a *Windows* platform.

SEVEN GRAPH TYPES Once you've started *Graph*, you're presented with the usual *Windows*-genre row of drop-down menus: File, Edit, Draw, View, Style, Gallery, and Options. The Gallery menu presents the seven graph choices: column (up and down), bar (left to right), area, line, pie, scatter, and table (spreadsheet-like) graphs, but not bubble or org charts.



FACT FILE

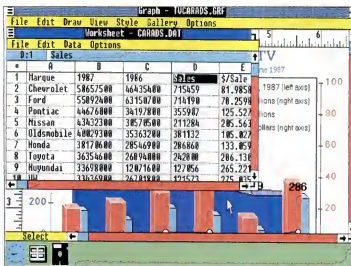


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Requires: 512K RAM, hard disk, *Microsoft Windows*, graphics adapter, DOS 2.0 or later, Mouse, 640K RAM, and AT-class PC recommended.

In Short: One of the very best presentation graphics programs (in a class with *Harvard Graphics* and *Freelance Plus*), with no-hassles links to 1-2-3 data files and a form of style sheets that lets you reuse your favorite graph formats with new data. It is too slow on a PC, needs a laser printer to take advantage of *Windows'* font capabilities, and is somewhat complicated for occasional users. Not copy protected.

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Data can be typed into Graph's worksheet or imported from 1-2-3. You can expand the worksheet to cover the whole screen, if desired. The worksheet looks like Microsoft Excel, but it's a passive spreadsheet; you can do only rudimentary calculations and sorts.

Most of the graphs can be overlaid on the others, but not all. It's analogous to "scissors cuts paper, paper hides rock, rock smashes scissors."

COMPLEX OPTIONS You'll quickly develop a love-hate relationship with the nine commands in the Options menu: Attributes, Axis, Data, Grid, Label, Legend, Projection, Regression, and Scale. They let you fine-tune the look of your graph in exquisite detail, but you'll go crazy trying to remember which commands give you access to which features. The less often you use *Graph*, the harder they'll be to remember.

You'll also grumble about *Graph*'s ill-behaved habit of rolling the menu shut after you make a selection, even if you need to make half a dozen selections to format the graph the way you want. You're forced to pull the menu window down half a dozen times. You'll be reminded of an aging window shade that snaps shut loudly every time the wind rustles or your cat brushes against it—scaring poor Hairball half to death.

Fortunately, *Graph* offers what

amounts to a style sheet, called Folders, in which you can store the settings for your favorite graphs. The Folders styles can be reused for unrelated new sets of data.

SPREADSHEET METAPHOR You enter data for a *Graph* graph in a worksheet window, which can expand to fill the screen. The worksheet, accessed by typing Ctrl-W or clicking the right button on your mouse, looks like an *Excel* or *Lotus 1-2-3* worksheet except that it's not a full-fledged spreadsheet—nor is it intended to be. You can do only limited massaging of the numbers—rudimentary sorts, cumulative column or row totals, or addition and multiplication by constants. Some users will find the worksheet-grid metaphor makes more sense for data entry than other graphics programs that want you to enter First Data Series, Second Data Series, and so on.

If you already have data in a 1-2-3 worksheet (or *Multiplan* or *VisiCalc*), you can directly import the values. And you should, especially if you need to perform any calculations or to round off your numbers. The current version of *Graph* reads

1-2-3 cells with only fixed values, not cells whose values are calculated by formulas.

Consider a graph comparing TV ad expenditures to products sold, in this case cars (see accompanying screen shot). Any calculations you did in *Graph*, such as dividing expenditures by units sold, would have to be done a cell at a time, and the results would have ten decimal places (which is how many decimal places will print if you attach value labels to graph points). The job would be handled far more easily in 1-2-3. Criticizing *Graph* for these failings is a bit unfair: other graphics programs may have no math or sorting capability, whereas *Graph* teases you with the choices it offers, so you wish for more. Of greater concern is the current inability to format numbers with dollar signs and commas. (The dollar sign in the screen shot was entered as text, then moved into position next to the value label.) Micrografix chairman Paul J. Grayson says a forthcoming upgrade should resolve some of the formatting limitations.


Graph also needs enough intelligence to keep values attached to bars and keep lines from bumping into adjacent bars if one bar is higher or lower than the other. There's a longhand alternative, which someone from Micrografix actually used to create one of the supplied sample graphs: manually enter the necessary value-label numbers as text, and nudge them into position with the mouse.

FINE-TUNING If you've got time to burn, you can fine-tune your graph in painstaking detail. You can add 3-D effects to bar, column, area, and pie charts in 1 percent increments (1 percent of what you're never told), then color or shade the fronts, sides, and tops of the bars or pies. You can pick any color that *Windows* and your PC can generate. (Too bad laser printers still give you any color as long as it's black.)

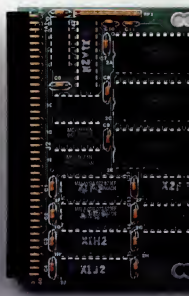
You can stretch or squeeze the graph legend, picking any font and size for the legend and axes that your output device produces. You can start the largest segment of a pie chart facing north, east, south, or west; if that's not good enough, you can pick the starting angle with 1-degree accuracy.

You can manually set the minimum, in-

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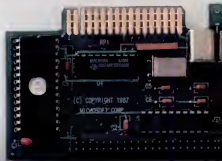
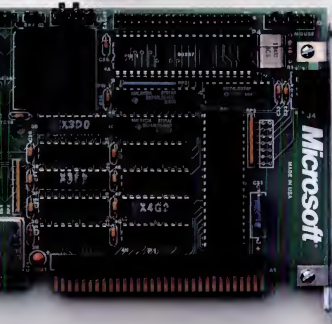
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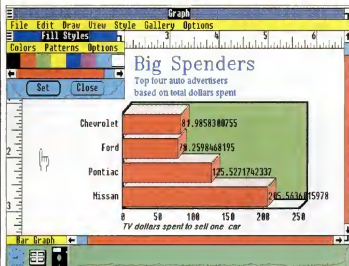
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■ WINDOWS GRAPH



When you attach values to graph points or bars, Windows Graph doesn't know enough to get out of its own way: sometimes the numbers spill onto the bars—or run into each other on column (vertical bar) graphs. In the current version, Graph prints values to ten decimal places, whether you want them or not, and it can't format them with dollar signs and commas.

crement, and maximum for your scale. If your graph zeros in on a comparison of intracompany productivity increases between 60 and 70 percent, by setting the graph min-max ranges at 60 and 70, you can make your 69 percent look worlds better than the 65 percent of the guy down the hall who has his eye on the marketing manager's job you covet. While you may never need or want that much flexibility, it's reassuring to know you can call upon it when needed.

About half the capability of *Windows Draw*, a separate, \$195 Micrografx drawing/paint product, is built in, allowing you to generate arcs, lines, geometric symbols, and text in dozens of colors, thicknesses, and fonts.

Most graphics programs offer you two or three title lines. *Graph* has none. Instead, it offers you the anarchy of unlimited choice. You can create and position text to your heart's content using a range of type fonts, and the text can be a title, but you'll have to eyeball a centered title into position yourself, and you'll have to use your own best judgment determining spac-

■ If quality of the finished product is more important than the temporary grief of the learning process, you can make a case for *Windows Graph* as the best program for the job.

ing between the first and second title lines if they're different type sizes. Type size is specified in points, which makes more sense for most users than arbitrary title sizes such as 20, 6, and 4.

Businessmen, forecasters, and academics sometimes need more sophisticated graphics than a red bar that doubles in height when you sell twice as many Air

Jordans, so *Windows Graph* includes linear, exponential, and logarithmic regression functions for trend analysis. You can also plot the axes of most graph types on a log scale if your data covers a wide range.

LIMITED HELP The *Windows Graph* reference manual is workmanlike; it should be adequate for skilled users and for the determined minority unwilling to concede defeat. Most users will shake their heads when they find a few terse sentences explaining the crucial part of a complex graphing operation.

There's no on-line help, and there's nothing like the marvelous "30 minutes to your first graph for users in a real hurry" booklet packaged with *Harvard Graphics*. Experienced *Windows* users will find that their *Windows* skills can get them started, but they'll need hours of practice to decipher *Graph*'s complexities.

MORE GOOD THAN BAD On the whole, *Windows Graph* is a superior product. If you're willing to put up with a stiff learning curve, if you don't mind working with a mouse (*Graph* is the kind of application made for pointing devices), and if you want state-of-the-art graphics, there are only a handful of choices: *Graph*, *Harvard Graphics*, *Freelance Plus*, and perhaps Hewlett-Packard's *Graphics Gallery*.

Graph still needs polishing in a number of areas. The manual needs work; there's no on-line help; some functions don't work as described (example: the Del key doesn't move a block of worksheet numbers to the cut-and-paste buffer); and the ability to format numbers on the axes with dollar signs, commas, and percent signs is sorely needed.

Make no mistake: *Graph*'s pluses far outweigh the minuses. If the quality of the finished product is more important than the temporary grief you suffer during the learning process, you can make a case for *Windows Graph* as the best program for the job—especially if you've signed on to the *Windows* bandwagon. If you use *PageMaker*, you'd be unlikely to covet any other graphics package.

Bill Howard is an executive editor of PC Magazine.

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POWER LINES:

9 NEW 386s

With 80386 microprocessor chips finally becoming available in volume, powerful new computers are pushing their way onto the market with a new standard in tow.

Somewhere in a bunker hermetically sealed against time and newspapers lives a grizzled gent with a white beard that droops down to his knees, a tattered gray uniform, and an unwavering devotion to the rebel cause. He—and he alone—has not heard the litany of virtues of the 80386 microprocessor promulgated by computer pundits and publications, and he alone is not awed by its potential.

To have not heard of the 80386 microprocessor and the computers built around it, you would have had to have spent all your

■ 386 COMPUTERS

waking hours of the last year in a sensory deprivation chamber. Indeed, the 80386 chip, the brains behind desktop boxes that can outthink most minicomputers, is the darling of everyone who wants to power his way through problems or to plow through half a dozen tasks at a time.

The praise begins with the 16-MHz top clock speed that has recently been upped to 20. By itself, that fleet electronic metronome makes most 80386-based PCs fly along twice as fast as IBM's best AT. And with the quick clock, the 80386 provides true 32-bit processing power—as yet untapped by most programs—as well as memory handling measured in terabytes (trillions of bytes) and the inherent ability to run multiple applications at the same time.

Connect an 80387 floating-point numeric coprocessor, and you've got a system that processes 4 million instructions per second—that's more than most minicomputers and even most earlier generations of IBM mainframes are able to handle.

Perhaps the only mark against the perfection of the 80386 microprocessor that's proffered by its advocates is that you're as likely to find one on your dealer's shelf as you are to find a Civil War soldier still at his post in his bunker. Because of bugs and ramp-up delays at Intel Corp., the 80386 chips themselves have been in short supply. Without the chips, 80386-based computers just can't be made—and that makes them hard to find anywhere.

The good news is that the supply of chips is beginning to pour into the pipeline, and with it is coming an increasing abundance of new hardware. While supply hasn't exactly topped demand—you may still find yourself waiting in line for your favorite 80386-based machine—deliveries are becoming quicker, and the number of available models is multiplying almost as fast as the 80387 chip. In fact, in the few months since *PC Magazine* took its first look at 12 80386-based PCs from Acer, ALR, Chicago Computer Connection, Compaq, CCI, Corvus, IBM, Kaypro, Laser Digital, PC Discount, PC's Limited, and Tandy (see "Heavy Metal—386s Weigh In," *PC Magazine*, Volume 6 Number 16), we've been able to round up another 9 competitors. More, including machines from NEC and Zenith, are on the

way but were unavailable at the time of our evaluation. Compaq Computer Corp.'s 20-MHz 80386s—the Deskpro 386/20 and the Portable 386—were considered in First Looks, page 33, *PC Magazine*, Volume 6 Number 19.

GROWING UP Along with the flurry of new models, a new maturity is emerging. As a product category, the 80386-based PC is sorting itself out and defining what you should expect in your purchase of such

■ The popularity of the Intel motherboard is defining an expansion standard and setting the pace for the entire field of 80386 computers.

high-powered hardware. Moreover, while these nine computers are the products of a new profusion, they nevertheless show the direction in which the market is heading. Should you have any doubt, it's full speed ahead into 32-bit territory.

One development continues to unfold. A standard is being set—but so far not by IBM. Although Compaq has sold the most 80386-based computers thus far (owing to its nearly 1-year lead on much of the competition), Intel itself has taken the lead in the standardization of 80386 technology, in that more computer makers are stuffing more of that company's 80386 system boards into their products than those of any other. Two-thirds of this sample of machines—six of the nine—have their minds made up the Intel way. In fact, five of them are built around the same Intel ISBC 386AT motherboard.

The popularity of the Intel motherboard is defining an expansion standard and setting the pace for the entire field of 80386 computers. While most companies that manufacture their own system boards tend to go in their own directions when it comes to implementing a full 32-bit expansion

bus, all Intel boards use the same bus design.

It's a clever arrangement, too. Much like the AT 16-bit extrapolation on the 8-bit PC bus, the Intel 32-bit slots simply enlarge their connector endowment with enough extra pins to handle the wider signals. Such slots are thus backward compatible and work with both 8- and 32-bit boards.

The sheer number of vendors that have adopted the Intel product gives aftermarket suppliers a ready market for 32-bit expansion products based on the Intel bus design. Aftermarket product makers need a large installed base to ensure that they can sell enough of a given device to recoup their development costs.

The increasing standardization around the Intel design paves the way for big, new memory boards and input/output adapters such as hard disk controllers that use the full 32-bit bus. Wider bus expansion cards will help clear up the one remaining bottleneck in most 80386 designs—moving information in and out. In addition, a strong aftermarket breeds competition, and that can mean lower prices on the expansion products that you need.

EXPANSION SCHEMES Perhaps the most important development is the adoption of the Intel expansion scheme by computer makers that do not use the Intel motherboard, such as American Research Corp. If other makers follow suit, the PC-compatible market will finally have the 32-bit standard it sorely needs.

However, the refuseniks who stodgily go their own, non-Intel way are not necessarily plotting to channel your dollars into the purchase of their products alone. Their proprietary bus designs are usually based on the needs of a specific memory architecture. The Intel standard sets a performance limit that other makers use their clever design techniques to exceed. For instance, a mating of higher-speed four-way interleaved memory with the Intel bus is not really feasible. Standardization in itself breeds stagnation, although as the PC and AT have shown, that's not necessarily bad, particularly when performance is set at an adequate level.

Improving performance is, in fact, the primary way that innovative firms are try-

INTEL'S REVISIONISM

Not all Intel 80386 motherboards are created equal. In fact, there have been five revisions of the first design, and the last two updates include some major changes.

Six of the 9 machines evaluated in this article are based on the Intel iSBC 386AT motherboard, as were 5 of the 12 evaluated in our first roundup of 386-based PCs. This system board choice does not make all of these computers identical, however. They vary in both philosophy and implementation, in component choice and workmanship. Some are aimed at a specific, tightly defined market, others forgo a specific target and take a scattergun approach, relying on the versatility of the 80386-based computer to let it ease into nearly any market niche.

The many models boast a host of different peripherals, from modest disk drives to the highest-performance, highest-capacity units using the latest high-speed interfaces. Some add a wealth of memory as standard equipment, others leave RAM a matter between you and your wallet, stingily allowing less than even DOS can manage.

Such design refinements belie a more fundamental difference. Not all motherboards are created equal, even when they all bear the Intel logo. The ubiquitous system board has endured several revisions since its first release. Currently it's at version 6, and another one may lie ahead, although Intel has not said when that might be. Each system board update has brought improvements, and those between versions 5 and 6 were particularly significant.

The latest Intel revision adeptly handles the 80387 numeric coprocessor at a clock speed of a full 16 MHz. Version 5 requires the use of an 80287 coprocessor, the fastest versions of which are limited to a speed rating of 10 MHz. Design refinements in the 80387 chip give throughput on number-intensive tasks a bigger boost than the different clock speeds alone imply. On PC Labs benchmark tests, for instance, the 80387 proved twice as fast as a 10-MHz 80287.

Memory handling is another major difference between the two latest versions of the Intel motherboard. Although both revision 5 and revision 6 are fully capable of dealing with 16 megabytes of RAM—1 for DOS and other system functions and 15 in the extended addressing area—the means of implementing that memory differ.

Revision 5 allows you to add up to two 32-bit memory expansion boards, each bearing 2 megabytes. The balance of the extended memory must be installed in 16-bit expansion slots, imposing a substantial penalty in memory access time.

In contrast, revision 6 allows the use of 32-bit expansion boards with 8 megabytes of capacity, allowing the wide-bus memory for the full limit of the microprocessor—and then some. The use of 32-bit memory is not mandatory, however, and 16-bit boards may also be used to flesh out system RAM.

Either version of the Intel motherboard will accept 16-bit EMS boards, and this EMS memory will not subtract from the available range of extended memory. Such 16-bit boards must be used, in fact, to enlarge the available DOS endowment to the 640K-byte maximum memory limit.

THE BUGS EMERGE Every new release of any computer product is likely to have a few bugs that remain in hibernation during beta testing and emerge from their cocoons only after the first sales. The Intel motherboards have proven no different—hence the five revisions to the original. According to some sources, version 6 is not yet bug-free, either, and may have difficulty handling some hardware options. No such problems arose during the testing of products based on these boards, however.

Currently, both boards are available to system manufacturers and either might be found in a new 80386-based computer. As time progresses, however, the later revisions will take over. Manufacturers are likely to phase them in as the new product arrives. Consequently, some of the features of individual computers reviewed here may change as the internals of the systems are upgraded. The machines reviewed are actual production samples, however, and the differences cited are exactly what may be expected in the open market.—Winn L. Rosch

ing to keep ahead of the standardized competition. By enriching their machines with more-responsive memory systems—four-way interleaving, buffering, or high-speed, zero-wait-state RAM—many manufacturers are making their products stand out from the Intel crowd (which, it must be admitted, is beginning to look more and more like a group of generic PCs). For example, PC Designs uses a huge, high-

speed buffer to speed up processing. NCR opts for fast RAM and no wait states. Other companies are finding ways of keeping to the standard while upping speed.

On the other hand, Computer Dynamics slips an extra 2 MHz into its clock to raise the overall performance of its 80386-based PC, the Micro System 386, by more than 10 percent, to 18 MHz, without foregoing conformity to the Intel standard.

COMMON ELEMENTS Despite their diversity, all nine of these new machines share several common elements. In particular, all are direct outgrowths of the 80286 AT-compatible computers of yesteryear. All share a chassis layout nearly identical to that of the old AT and offer the same (or nearly the same) disk expansion opportunities. All occupy the same desktop footprint as the original AT. All accept ordi-

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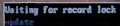
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■ 386 COMPUTERS

nary AT-style expansion cards of normal length and full AT height.

And all are expensive. The fully configured systems we evaluated run from \$4,758 for the ARC 386i to \$8,645 for the Wang 380, a machine that is probably intended to be used in a Wang-dependent corporate setting as a high-powered Wang-DOS-compatibility solution. The Wang 380 is the type of 386-based PC that—like others from AT&T, ITT, NEC, Data General, and Unisys—is designed and priced to function in an environment that includes both mainframes and micros. It's unlikely that they will ever be price leaders in this category.

While none of these machines even acknowledge the new IBM Personal System/2 line, they offer something that may just be better. They make the transition to full 32-bit speed and processing power easy. They let you preserve your investment in expansion boards and displays. And they show that there's still a lot of life—and performance—left in the 6-year-old PC standard.

AMERICAN RESEARCH CORP.

ARC 386i

Perhaps a better name for American Research Corp., the creator of this Sino-American computer, would be International Research, since its system board is made in the United States, while the metalwork bears a legend stating that it was crafted in Taiwan.

Take a look at the construction and operation of the ARC 386i, and you'll know that it gives you the best of both worlds. The Occidental electronics meet the Intel performance standard in more ways than you're likely to expect. The Oriental mechanicals are superbly crafted and finished. Overall, the ARC 386i is a very pleasing machine—and one that may portend the future of 80386 standards.

Although the ARC 386i system board is manufactured by Wedge Technology, it conforms closely to the standard and specifications set by Intel's iSBC 386AT motherboard. Most important, its twin 32-bit expansion slots are plug-compatible with those of the Intel board. Although the ARC documentation makes no reference to this, the transplant of a 2-megabyte Intel



The fact that the ARC 386i is not built around an Intel 80386 motherboard doesn't really matter, because its two 32-bit slots are fully compatible with the Intel standard. Standard equipment includes 512K bytes of RAM and one floppy disk drive. Everything else is optional, allowing you to configure the system exactly as you want it.

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■ 386 COMPUTERS

memory expansion board into the ARC 386i was completely successful.

Memory configuration (and therefore performance) also conforms to the Intel standard. The 80386 microprocessor is driven by a 16-MHz clock. For those who get paid by the hour or want to achieve greater compatibility with weird software, the processing speed can be reduced to 8 MHz either by pressing a combination of keys or by running a software utility supplied by ARC.

SYSTEM MEMORY System board memory consists of 164K- by 64K-bit dynamic RAM chips rated at 120 nanoseconds and interleaved in two banks, cutting in half the effects of the two wait states required in memory reads. All system board RAM (a total of 512K bytes) is assigned to DOS operations.

The two 32-bit slots operate at the full 16-MHz speed of the microprocessor and accommodate either 2- or 8-megabyte RAM expansion boards, which are addressed in the extended memory area. DOS memory can be expanded only in 16-bit slots. With either 16-bit or 32-bit RAM, the addressing limit of the system is 16 megabytes.

System performance can be enhanced with a 10-MHz 80287 numeric coprocessor, which must be mounted on a special adapter board. With regard to the use of an 80387 microprocessor, the documentation states, "Please note that 80387 will not be

functioning on this board without modification."

The Wedge system board features eight expansion slots—two 8-bit, four 16-bit, and two 32-bit. All are full-length and AT-height, and all but the last pair operate at 8 MHz for compatibility with AT-style expansion products. (ARC does not specify whether its 32-bit slots can be used with 8-bit boards.)

The standard equipment included with the ARC 386i fills one 16-bit slot with a Western Digital WD1003 combined hard-and-floppy disk controller. The evaluation system was also equipped with ARC's proprietary EGA-compatible video board sequestered in an 8-bit slot.

As with the IBM PC AT, a continuously running clock/calendar and CMOS configuration memory are built into the system board. When the power is switched off, this memory is kept fresh by a pack of four AA cells attached (with double-stick tape) to the rear panel in a clever battery holder that completely encases them and prevents them from breaking free at inopportune moments. The system is configured using a software setup utility. A wealth of system board jumpers is used to configure memory and hardware options.

The ARC BIOS bears an Award Software copyright. The leading alternative to the Phoenix Technologies BIOS, the Award firmware proved similarly compatible and did not fail to run any commercial applications that we tried.

The standard features of the system do not include any serial communications facilities, although a parallel printer port was included as part of the optional ARC video adapter.

Except for cosmetic differences, the case of the ARC 386i conforms to the ordinary AT arrangement. Two half-height drive bays are given front-panel access on the right with an extra invisible half-bay tucked underneath. A full-height hard disk bay is ordinarily hidden inside the system unit.

The factory packs the ARC 386i with a 5¼-inch high-density floppy disk drive in the bottom floppy disk drive half-bay. The evaluation machine was also equipped with a Seagate ST4051 hard disk drive, a full-height 40-megabyte unit that delivered a 36-millisecond average access time in

PC Labs benchmark tests. Partitioning software is included with the MS-DOS 3.1 that's a standard part of the system. With an EGA monitor, the machine was priced at \$4,758.

IN STYLE The styling refinements of the ARC 386i include a silk-screen mylar almost-square control panel in the upper left of the front of the machine. Although colorful, it's less functional than an AT panel and features only a drive activity indicator and a cylindrical keylock that

■ For those who want to achieve greater compatibility with weird software, the ARC 386i's processing speed can be reduced to 8 MHz.

switches off the keyboard but does not secure the top of the case.

The whole machine, including the rear panel and front bezel, is finished in the same very pale gray paint. In addition to the eight expansion board retaining brackets on the rear panel, two slotless extra brackets are available for mounting an overflow of port connectors.

The keyboard connector is located near the center of the rear panel, as are the power-in and switched power output jacks and a recessed selector slide switch for 115- or 230-volt AC operation. The on/off switch, an IBM-style red paddle, is located near the right-rear corner of the chassis. The power supply is made by Sourcecetek in Taiwan and is rated at 200 watts. The system bears an FCC Class A certification sticker.

ARC's choice of a keyboard is a 101-key copy of IBM's Enhanced Keyboard that is manufactured by Maxi-Switch. For those who rely heavily on the left-hand Ctrl key, ARC includes replacement caps for switching it and the left-hand Caps-Lock key. The rubber dome technology of this keyboard gives good snap-over tactile

**FACT FILE**

ARC 386i
American Research Corp.
1101 Monterey Pass Rd.
Monterey Park, CA 91754
(213) 265-0835

List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, DOS 3.2, \$2,302; with 40-Mbyte hard disk, \$3,672; EGA monitor and card, \$1,086; 2-Mbyte RAM expansion board, \$645.

In Short: The ARC 386i is a solid piece of workmanship that is one of the few machines here without an Intel motherboard. Compatibility, however, is not a problem. Lacks FCC Class A certification.

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■ 386 COMPUTERS

feedback but no audible feedback.

The evaluation system included an optional Tatung CM-1380-F EGA display in addition to the ARC EGA adapter. The monitor proved a bit disappointing. The unit is stylish, but it lacks a tilt-swivel base, and the characters in its on-screen display bloom badly as screen brightness is increased. Although colors are saturated and the image is sharp at low luminance levels, the characters blur almost to unreadability when the set is used in a bright environment.

Overall, the ARC 386i is very likable and very compatible with both the AT and the Intel standards. Its good workmanship and low price (for a 386-based system, that is) recommend it highly—but buy it without a display system and add your own.

CAE/SAR SYSTEMS INC.

CAE/SAR 386

An original equipment manufacturer (OEM) product like the Intel iSBC 386AT board is designed to be a platform for customization. CAE/SAR Systems takes that to the extreme, offering its CAE/SAR 386 in a wide-ranging variety of configurations, mostly fitted to a particular application and a particular user need. The emphasis, as the company name implies, is on computer-aided engineering.

The peripheral choices of the evaluation CAE/SAR system proved to be a particularly favorable combination for the intended task—its high-speed disk storage is exactly the right accent required for the large files used in computerized engineering, and the EGA display system offers the best IBM standard that compatibility currently offers.

The foundation of the CAE/SAR 386 is a typical AT-style chassis, nearly identical in size, shape, color, and features to the IBM prototype. At right are the requisite five half-height disk drive bays in strict IBM arrangement—two on the right that have front-panel access, a third tucked beneath, and a pair forming an internal hard disk mounting area.

Front left is the standard control panel with disk drive activity and power indicators, plus a cylindrical case-and-keyboard keylock. A big red paddle at the rear right of the chassis controls system power. At

the rear, line power in, switched power out jacks, and a recessed slide switch for selecting 115- or 230-volt AC operation complete the control facilities for the 200-watt power supply. Built-in CMOS mem-

ory and a clock are kept fresh by four AA batteries in a holder attached to the rear panel.

Among the five punched holes in the rear panel that allow mounting connectors



CAE/SAR Systems, the manufacturer of the CAE/SAR 386, offers its machine in a wide variety of configurations, the best of them designed for computer-aided design and engineering tasks. The 72-megabyte Control Data hard disk included for evaluation is a good choice for such work: its average access time was a blistering 15 milliseconds.

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CIRCLE 135 ON READER SERVICE CARD

■ 386 COMPUTERS

without using expansion slots, three are filled with blanks, one holds a male DB-25 for the standard equipment serial port, and another is occupied by a female DB-25 for the parallel port. The keyboard jack is just below. No indication of FCC certification was visible on the back of the evaluation machine.

EXPANSION SLOTS The eight retaining brackets evidence the matching expansion slots inside—two equipped with an 8-bit data bus, four with 16-bit, and two with Intel's 32-bit bus (which can also function as 8-bit slots). All expansion slots are full-length and AT-height.

The centerpiece of the CAE/SAR 386 is, of course, the Intel iSBX 386AT system board, which affords about twice the performance of an ordinary IBM PC AT thanks to its 80386 microprocessor operating at 16 MHz, burdened with the equivalent of one wait state during 32-bit memory accesses. The two wait states required by its 120-nanosecond RAM are mitigated by rapid two-way interleaving of its banked memory.

The base memory consists of 16 4K- by 64K-bit dynamic RAM chips for a total of 512K bytes of RAM split into 2 banks. CAE/SAR added an additional 2 megabytes to the evaluation system in the guise of a single 32-bit expansion board. A second such board may be installed to increase total 32-bit RAM to 4 megabytes.

The addressing limit of the system is 16 megabytes, the balance of which must be derived from 16-bit expansion cards (which are substantially slower than 32-bit RAM).

Besides the narrower bus, performance of the 16-bit slots is also impeded by the 8-MHz clock controlling all expansion slots except those used with a 32-bit data path (which operate at the full 16-MHz speed of the microprocessor). The entire system can be slowed to the equivalent of an 8-MHz clock rate by pressing a three-key combination.

Because computerized engineering demands extensive number crunching, CAE/SAR has equipped the CAE/SAR 386 with a 10-MHz 80287 numeric coprocessor. The system board used in the evaluation system is not compatible with the 80387 chip.

CAE/SAR goes in its own direction for its mass-storage connections. The standard-equipment high-density 5¼-inch floppy disk drive is operated by a dedicated floppy disk controller tucked away in an 8-bit expansion slot. Although the 8-bit interface may handicap the speed of floppy-disk-based data transfers, for computerized engineering it does not represent a significant problem. At most, the floppy disk is nothing more than a data interchange device; all the hard work is reserved for the hard disk.

That's where CAE/SAR excels. The disk of choice for the evaluation machine was a 72-megabyte Control Data unit. Not only did its average access time test out at 15 milliseconds, its ESDI interface transferred data to and from the disk at 10-MHz—twice as fast as that of any other computer examined here. As a result, reading large files is amazingly quick, and the difference is easy to perceive even with such routine chores as reading a directory. With the 2-megabyte RAM expansion and an EGA monitor, the evaluation system was priced at \$4,695. The stripped-down base system, which includes a 40-megabyte hard disk, sells for \$2,895.

The evaluation machine arrived with the disk partitioned with PC DOS 3.3 and a second partition set up with UNIX. The machine, equipped with a Phoenix Technology BIOS, is compatible with both operating systems.

The controller for the disk drive was a Western Digital WD1005 EDSI hard-disk-only device, which consumed one of the 16-bit expansion slots.

CLEAR IMAGE A Twinhead CT-8090 EGA adapter filled the other 8-bit slot of the evaluation system. Connected to it was a Casper EGA display, and the combination proved satisfying. The image on the tube was bright and clear at all intensities,

■ **CAE/SAR Systems** goes in its own direction for its mass-storage connections. Its high-density 5¼-inch floppy disk drive is operated by a dedicated controller.

and the monitor itself was quite good looking with its built-in tilt-swivel base.

The CAE/SAR keyboard was not such a joy. A Behavior Tech Computer product, its key layout approaches that of the 101-key IBM Enhanced Keyboard but is different enough that anyone going from one to the other will suffer the headache of negative transfer—perhaps mashing your fist through it, as this reviewer attempted.

You won't worry about damage because nothing could make the feel of its keys worse. It offers little tactile feedback, and no audible feedback, and the actuation is inconsistent. In consolation, much of CAE is handled with mice, and perhaps this keyboard should be fed to them.

Apart from the keyboard, the CAE/SAR 386 is a cohesive whole that will effectively fulfill its intended purpose. Because CAE/SAR essentially configures its products to its customers' specifications, this single machine cannot represent all of the possibilities. The workmanship and integration, however, should apply to any product offered by CAE/SAR, and both rate highly.



FACT FILE

CAE/SAR 386

CAE/SAR Systems Inc.
P.O. Box 50243
Palo Alto, CA 94303
(415) 949-3816

List Price: Model 40 with 512K RAM, 1.2-Mbyte floppy disk drive, 40-Mbyte hard disk, \$2,895; Model 80 with 70-Mbyte hard disk, \$3,495; Model 140 with 130-Mbyte hard disk, \$4,395; EGA monitor and card, \$600; Model 40 with 2.5 Mbytes RAM, \$3,495; Model 80 with 2.5 Mbytes RAM, \$4,095.

In Short: A relatively low price tag and high degree of quality make the CAE/SAR 386 an option worth considering. Systems are custom-configured for each user.

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COMPUTER DYNAMICS INC.

Computer Dynamics Micro System 386

Remember the good old days—when penny farthing bicycles were in vogue, you had to crank, choke, or stoke your motorcar to start it, and boosting performance was simply a matter of slipping a high-frequency crystal into your AT? The folks at Computer Dynamics obviously have elephantine memories, because they've found one of the best ways to take a step forward is to inch a little bit backward first and switch crystals.

Although the internals of the Computer Dynamics Micro System 386 match most of what's on the market today (Intel OEM system boards), by the mere expedient of upping the crystal frequency (to 36 MHz, from 32) and hand-picking parts, the company has created a PC more than 10 percent faster than most of the rest of the field. The result is an 18-MHz 80386-based computer that hints at the potential of the 20-MHz chips to come.

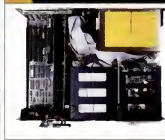
Computer Dynamics' starting point is the same as for untold dozens of AT clones and a growing number of 80386-based machines: basically a knockoff AT chassis that's almost a perfect match for the IBM product except the paint is more gray than beige.

The controls and the disk drive areas are identical to those of the original AT. At the upper left of the front panel are the power and drive activity indicators accompanied by the case-and-keyboard keylock. Below, a long row of vertical ventilation slots march in formation.

At right, two half-height disk drive bays peek through the front-panel bezel, over-and-under style. Below them is an extra half-height bay for a half-height drive or the bottom half of a full-height hard disk. Hidden inside the chassis is another full-height hard disk drive bay.

A big red power-switch paddle decorates the rear of the right side of the case. And the rear panel hosts a keyboard connector, power-in, and switched power output jacks.

The 205-watt power supply runs from either 115- or 230-volt AC, selectable through a recessed slide switch on the back of the chassis.



One of the speediest of 16-MHz 80386-based PCs is the Computer Dynamics Micro System 386, which tweaks effective 18-MHz performance out of its Intel motherboard by increasing the crystal frequency from 32 to 36 MHz. Component parts, including hard disks, controllers, and monitors, are of high quality and come together to make a machine that's tough to beat.

CLASS RATING Unlike the IBM original that the Computer Dynamics case clones, however, a male DB-25 and a female DB-35 connector poke through near the center of the back panel to link the outside world to the standard equipment serial and parallel ports of the Micro System 386. Moreover, the FCC sticker on the rear panel gives the Micro System 386 only a Class A rating, less stringent than you'll find for an IBM desktop machine.

Lining the bottom of the chassis is the slightly modified Intel iSBC 386AT motherboard. Although running at higher than normal speed, its 80386 microprocessor endures the same two wait states as other machines with the same system board, and it similarly benefits from its two-way memory interleave. The result is one effective wait state at 18 MHz, more than enough to beat out competing 16-MHz machines and even the original Compaq Deskpro 386, despite the exotic memory arrangement of the latter.

The Intel motherboard provides a socket for an 80387 numeric coprocessor, which Computer Dynamics dutifully filled in the evaluation machine for added performance. To slow things down, throughput can be reduced by half through the introduction of additional wait states, controlled by pressing a combination of keys on the keyboard.

On-board memory is the same 512K that's standard in all Intel-based machines,

made up of a total of 16 120-nanosecond 4K- by 64K-bit chips. In the evaluation machine, Computer Dynamics added 2 megabytes on a 32-bit memory chip in an expansion slot.

Normally, all that added RAM would function only as extended memory, but with the Micro System 386, Computer Dynamics includes Quarterdeck Office Systems' Expanded Memory Manager, which allows any amount of the extended memory to be used as EMS storage.

The ROM BIOS bears a Phoenix Technology copyright, which—besides being Intel's standard ROM for the motherboard—guarantees good compatibility.

The system board is equipped with eight expansion slots. Six operate at 9 MHz—two using the 8-bit XT bus, four the 16-bit AT bus. Two 32-bit data path slots (for memory expansion) operate at full bus speed (18 MHz). These last two can also accommodate 8-bit expansion boards but slow down to 9 MHz when such a board is inserted.

In the evaluation machine, one slot of each bus size was filled—an 8-bit with an EGA adapter, the 16-bit by an AT-style combined hard-and-floppy-disk controller, and a 32-bit by the aforementioned memory board.

DISK DRIVE CHOICES The standard floppy disk is a 5¼-inch, high-density drive in the topmost slot. In the evaluation machine, Computer Dynamics docked a Priam ID-40 hard disk in the internal bay—a drive that proved to be an excellent choice with a 26-millisecond average access time. To make all 40 megabytes of this drive work with DOS, Computer Dynamics included Storage Dimensions' *SpeedStor* software, which allows the drive to be configured into multiple DOS volumes, one large 40-megabyte volume, or an almost unlimited number of other arrangements.

The Micro System 386 also includes the requisite clock/calendar and CMOS configuration memory. To keep these alive when line power is shut off, Computer Dynamics uses four AA batteries in a holder attached to the power supply inside the chassis.

A wealth of jumpers on the motherboard allows customization of system fea-

tures, such as assigning the system board serial port to COM1 or COM2 and the parallel port to LPT1 or LPT2. To document these settings, Computer Dynamics includes the Intel manual for the motherboard, which goes through all of the motherboard's details.

The finger interface of the Micro System 386 is a BTC (Behavior Tech Computer) keyboard that's laid out in an approximation of the 101-key IBM

■ The Computer Dynamics Micro System 386 runs with one effective wait state at 18 MHz, more than enough to beat out competing 16-MHz machines.

Enhanced Keyboard design. However, enough details don't match that typing is a torture for anyone familiar with the real IBM product.

For instance, the already badly placed IBM left-hand Ctrl key has yielded some space to a novel Macro key, and the Backslash has sneaked down to the bottom row next to the right-hand Ctrl key. As if that weren't enough, the feel of the keyboard is mediocre at best, with no tactile feedback and no audible feedback. It's a blot on an otherwise successful machine.

On the other hand, the Casper EGA display included with the Micro System 386 proved a satisfying and enjoyable monitor. Compact for its screen size (about 14 inches diagonally) and with a built-in tilt-swivel base, it proved a bright and colorful desktop companion. The configured evaluation unit carried a \$5,588 price tag. Base systems start at \$3,295.

For squeezing every inch of performance from the Intel motherboard, the Micro System 386 is remarkable. Its workmanship is good, and with the exception of the keyboard, the choice of peripherals



FACT FILE

Computer Dynamics Micro System 386

Computer Dynamics Inc.

2201 Donley, #365

Austin, TX 78758

(512) 836-5707

List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, \$3,295; 40-Mbyte hard disk, \$936; 60-Mbyte hard disk, \$1,199; EGA monitor and card, \$698; 2-Mbyte RAM expansion board, \$1,000.

In Short: By speeding up its clock to 18 MHz, the Computer Dynamics Micro System 386 squeezes every ounce of performance out of the Intel motherboard and which it is built. Lacks FCC Class B certification.

CIRCLE 689 IN READER SERVICE CARD

*“I live out...my life with the
nightmare that the Soviet Union
will one day discover...
public relations.”*

Marco Polo, If You Can, 198

*“...the point,
surely,
isn't that
Victorianism
can't
anaesthetize
lust.”*

National Review,
June 28, 1965

BUCKLEY

*“...a philosophical
paella...”*

National Review, July 12, 1965

**“I would like to electrocute
everyone who uses the word ‘fair
in connection with income tax
policies.”**

National Review, July 12, 1965

*“...under the rubric
of mutual
assured destruction.”*

National Review, July 12, 1965

*“Anthony Brogan reflected on
the internationally practiced,
slightly open-fingered, finger
loosely-bent, counter-clock-
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■ 386 COMPUTERS



386 Computers: Summary of Features

(Products listed in ascending base price order)

	ARC 386i	CAE/SAR 386	Micro 1 386 PC	PC Designs BV-386	Computer Dynamics Micro System 386	Delcom 386
Base price	\$2,303	\$2,895	\$2,940	\$3,125	\$3,295	\$3,995
BASE PRICE INCLUDES						
RAM	512K	512K	512K	1 Mbyte	512K	512K
Floppy disk drives	1 1.2-Mbyte	1 1.2-Mbyte or 1 1.44-Mbyte (3 1/2-inch)	1 1.2-Mbyte	1 1.2-Mbyte	1 1.2-Mbyte	1 1.2-Mbyte
Hard disk drives	None	None	43-Mbyte	40-Mbyte	None	None
Clock/calendar	●	●	●	●	●	●
Software	DOS	None	None	DESQview	None	Utilities
Monitor	None	None	Monochrome	None	None	None
Ports	None	1 serial, 1 parallel	1 serial, 1 parallel	2 serial, 1 parallel	1 serial, 1 parallel	1 serial, 1 parallel
Slots	2 32-bit, 4 16-bit, 2 8-bit	2 32-bit, 4 16-bit	2 32-bit, 4 16-bit, 2 8-bit	6 16-bit, 2 8-bit	2 32-bit, 4 16-bit, 2 8-bit	2 32-bit, 4 16-bit, 2 8-bit
Power supply (watts)	200	200	192	220	205	220
Reset key	○	○	○	●	○	○
Keyboard style	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced

CONFIGURATION TESTED						
Price	\$4,758	\$4,695	\$4,580	\$3,125*	\$5,586	\$5,200
Configuration	40-Mbyte hard disk, EGA monitor	70-Mbyte hard disk, EGA monitor, 2-Mbyte RAM card	43-Mbyte hard disk, EGA monitor, 2-Mbyte RAM card, 80387 coprocessor	40-Mbyte hard disk	40-Mbyte hard disk, EGA monitor, 2-Mbyte RAM card	40-Mbyte hard disk, mono- chrome monitor flat-screen

SPECIFICATIONS						
Clock speed (MHz)	16	16	16	16	16	16
Controller card handles	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives
32-bit memory expansion implementation	Intel-standard slot	Intel-standard slot	Intel-standard slot	Motherboard	Intel-standard slot	Intel-standard slot
Math coprocessor	80287	80387	80287 or 80387	80287	80387	80287
RAM chips	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM

OTHER						
Warranty	2 years	180 days	1 year	1 year	90 days, 1 year optional, \$75	1 year
BIOS manufacturer	Award	Phoenix	Phoenix	American Megatrends	Phoenix	Phoenix

■ —Indicates Editor's Choice. ● —Yes ○ —No *32-bit expansion available through bus extender daughtercard. †Evaluation unit did not include a monitor.



TeleVideo Tele 386	NCR PC916	Wang 380
\$4,899	\$6,353	\$6,495

2 Mbytes	2 Mbytes	2 Mbytes
1 1.2-Mbyte	1 1.2-Mbyte or 1 1.44-Mbyte (3 1/4-inch)	1 1.2-Mbyte
40-Mbyte	30-Mbyte	None
●	●	●
DOS, GW-BASIC	DOS, diagnostics	DOS, Microsoft Windows, tutorial
None	None	None
1 serial, 1 parallel	1 serial, 1 parallel	1 serial, 1 parallel
2 32-bit, 5 16-bit, 1 8-bit	6 16-bit, 2 8-bit*	2 32-bit, 4 16-bit, 2 8-bit
220	220	229
●	○	○
IBM Enhanced or original AT	Proprietary	Proprietary

\$5,749	\$8,298	\$8,645
43-Mbyte hard disk, EGA monitor	70-Mbyte hard disk, EGA monitor	44-Mbyte hard disk, EGA analog monitor

16	16	16
2 floppy and 2 hard disk drives, tape drive	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives
Proprietary slot	Proprietary slot	Intel-standard slot
80287 or 80387	80287 or 80387	80287
DRAM	DRAM	DRAM

90 days	1 year	1 year
TeleVideo	NCR	Phoenix

rates as excellent. The Micro System 386 should prove itself a fast workhorse for nearly any business situation.

MICRO 1

Micro 1 386 PC

Calling any 80386-based PC entirely ordinary more than hints at how jaded PC power users have become, but it also shows how quickly the market has upped its standards into the stratosphere. Viewed objectively, the Micro 1 386 PC rivals machines costing more than 20 times as much, providing more power than was imaginable on a desktop 5 or 10 years ago. Subjectively, it runs neck-and-neck with competition from some revered manufacturers.

Yet the Micro 1 386 PC is ordinary. It's a machine almost anyone could put together—you can look up the prices of all its components in catalogs, buy a bag of screws to fasten everything together, and finish making a very similar computer half an hour after the parts arrive on your doorstep. But Micro 1 has done all that for you, and unless you're a perfectionist, the company has probably done a better job, removing the worries and adding the functionality.

FAMILIAR MOTHERBOARD The heart of the Micro 1 386 PC is Intel's now familiar iSBX 386AT motherboard. By definition, it's based on the 80386 microprocessor coupled with a memory system that yields the equivalent of one-wait-state operation on most chores at a clock speed of 16 MHz.

The system's base endowment of 512K bytes of memory consists of 16 4K- by 64K-bit dynamic RAM chips rated at a 120-nanosecond cycle time. An additional 2 megabytes of extended memory was available in a 32-bit expansion slot.

The memory imposes two wait states between accesses by the microprocessor but is interleaved in two banks, which effectively eliminates the two wait states about half the time (yielding the equivalent of one wait state). In tests, the Micro 1 386 PC proved almost exactly twice as fast as an 8-MHz AT.

To enhance the performance of the evaluation machine, Micro 1 installed an optional 80387 numeric coprocessor in the

socket provided on the system board.

The design of the Intel board imposes a serious shortcoming on DOS users: the only way supported by Intel to push DOS memory to the 640K limit is through the use of a 16-bit expansion board. Two proprietary 32-bit sockets allow enlarging extended memory capacity to 16 megabytes, all two-way interleaved, with two wait states, and operating at 16 MHz.

The BIOS firmware, written by Phoenix Technology, also includes a routine to simulate 8-MHz operation for compatibility purposes. The low speed is simulated by adding more wait states rather than knocking down the clock speed. Shifting between performance levels requires only pressing a keystroke combination—Ctrl-Alt-1 to go up, Ctrl-Alt-2 to go down.

System board circuitry also includes a serial port and a parallel port. Jumpers allow setting the former as COM1 or COM2, setting the latter as LPT1 or LPT2, or defeating either of the ports entirely. Micro 1 provides a male DB-25 connector for the serial connection and a female DB-25 for the parallel connection, both secured to cutouts in the rear panel of the system chassis. Blanked-off cutouts for another DB-25 and two DB-9 connectors are available for additional connections.

The system board includes both an AT-style clock/calendar and CMOS configuration memory with support for almost 50



FACT FILE

Micro 1 386 PC

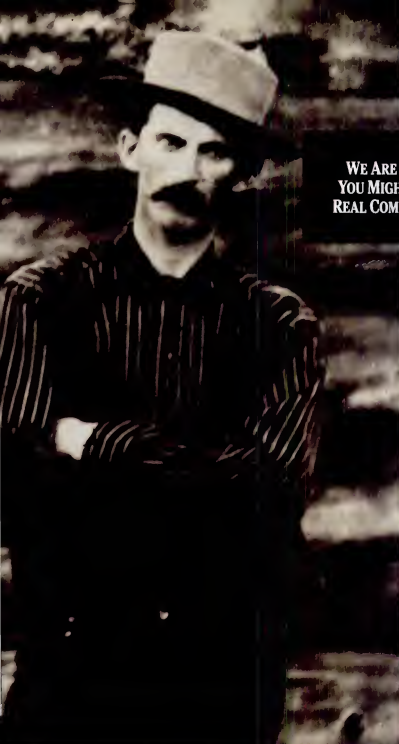
Micro 1
557 Howard St.
San Francisco, CA 94105
(415) 974-5439

List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, 43-Mbyte hard disk, monochrome monitor, \$2,940; with 2-Mbyte RAM expansion, EGA monitor and card, 43-Mbyte hard disk, 80387 coprocessor, \$4,580; with 70-Mbyte hard disk, \$5,080; 80287-10 coprocessor, \$250; 2-Mbyte RAM expansion board, \$620.

In Short: The Micro 1 386 PC doesn't offer much technological innovation, but its high-quality components make it a high-quality system at a low price. Lacks FCC Class B certification.

CIRCLE 688 ON READER SERVICE CARD





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REAL COMPATIBLE.**

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8 0 0 - 4 2 6 - 5 1 5 0

CIRCLE 539 ON READER SERVICE CARD



At \$4,580 for a fully configured EGA system, including a 43-megabyte hard disk, the Micro 1 386 PC is one of the better values in the 80386-based-PC crowd. Although it lacks the kind of technological innovation that would make it an outstanding performer, it is a solid machine that points to a future of well-built yet low-cost 386 systems.

different hard disk configurations. Both features are jumper-defeatable. Even when the computer is switched off, the CMOS memory and clock are kept alive by a four-pack of AA cells attached to a side of the power supply. System options are set up through software provided with the Micro 1 386 PC.

Expansion slots include four 16-bit and two 8-bit, all operating at 8 MHz and imposing additional wait states. The two 32-bit slots are also compatible with 16-bit or 8-bit expansion boards. Although they operate at 16 MHz with 32-bit boards, they degrade to 8 MHz when expansion boards with narrower interfaces are used. All expansion slots are full-length and AT-height.

In the evaluation machine, one 32-bit slot was occupied by 2 megabytes of extended memory, one 16-bit slot was filled with a Western Digital combined hard-and-floppy-disk controller card, and an 8-bit slot holds a video adapter.

ON THE CASE The case of the Micro 1 386 PC is almost a refugee from an AT-compatible assembly line. Only the ventilation grooves on the front panel have been rearranged so that they run horizontally. A slight improvement on the AT prototype, the Micro 1 386 PC provides the equivalent of five half-height drive bays, with all three on the right having front-panel access, and with individual blank panels for the two ordinarily unused slots. The full-height internal drive bay is hidden from the outside world.

The factory fills the upper-left bay with a 5 1/4-inch, high-density (1.2-megabyte) floppy disk drive. The bottom half of the internal bay of the evaluation unit was filled with a Seagate ST251 hard disk drive. The drive arrived preformatted using a special Seagate-only version of On-track Computer Systems' *Disk Manager* program, which configured strangely—with one 800K-byte partition and one 42-megabyte partition.

The requisite control panel on the upper left of the front of the machine includes a hard disk drive activity indicator, a power indicator, and a case-and-keyboard keylock. A legend and space for a high-speed indicator is provided but not filled. The keyboard itself plugs into a jack located



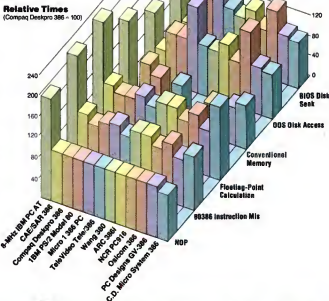
Benchmark Tests: 386 Computers

The NOP and 80386 Instruction Mix tests showed fairly consistent results, with all 386 systems performing within a 15 percent range of the Compaq Deskpro 386. The Computer Dynamics Micro System 386, which was running at a clock speed of 18 MHz, produced an NOP time that was 11 percent faster than that of the Deskpro 386.

In disk access tests, several units, including those from Wang and PC Designs, outperformed the Deskpro 386. The Micro System 386 performed very well, as did our Editor's Choice, the NCR PC916, which was about 10 percent faster overall than Compaq's machine. The winner, though, was the CAE/SAR 386. Its ESDI hard disk interface made it the fastest of all the machines in the disk access tests.

None of these computers, however, matched the stunning results of the PC's Limited 386-16, which was tested in the first roundup of 386-based PCs ("Heavy Metal—386s Weigh In," PC Magazine, Volume 6 Number 16). Configured exclusively with high-speed static-RAM chips, it remains the overall speed champion.

Relative Times
(Compaq Deskpro 386 = 100)



Performance Times

(Times given in seconds except where noted)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)
6-MHz IBM PC AT	4.17	8.96	35.60	1.32	42.54	37.20
CAE/SAR 386	2.09	4.62	17.36	N/A	20.55	15.17
Compaq Deskpro 386	2.09	4.01	15.50	0.77	33.32	29.20
IBM PS/2 Model 80	2.09	4.39	15.60	0.63	33.25	33.60
Micro 1386 PC	2.09	4.62	17.35	N/A	55.43	42.79
TeleVideo Tele386	2.09	4.01	15.16	0.82	32.41	31.91
Wang 386	2.09	4.62	17.30	N/A	31.64	29.10
ARC 386i	2.08	4.61	17.30	N/A	37.95	35.19
NCR PC916	2.08	3.95	14.28	0.50	29.45	27.03
Osicom 386	2.08	4.61	17.30	N/A	51.68	39.32
PC Designs GV-386	2.08	3.68	13.62	0.57	30.68	27.72
Computer Dynamics Micro System 386	1.87	4.23	22.14	0.66	28.67	26.11

N/A—Not applicable: not enough conventional memory to run test.

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 10K loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The Conventional Memory benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3, and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

■ 386 COMPUTERS

near the center of the rear panel.

The power supply, made by Fortron, is rated at 192 watts and is switch-selectable to operate at 115 or 230 volts AC. The system on/off switch is the standard big red paddle on its side. A jack is available for a switched power connection to a monitor.

The Micro 1 386 PC keyboard is a Maxi-Switch simulation of the 101-key IBM Enhanced Keyboard design. The layout matches the prototype's, but the feel is somewhat lighter and quieter, thanks to the rubber dome technology used. Micro 1 includes extra CapsLock and left-hand Ctrl keycaps so that you can properly swap the positions of these keys from where IBM's diabolical anti-ergonomic engineers have assigned them.

Micro 1 supplied a complete display system with the evaluation unit, including a high-resolution display adapter called the

■ The Micro 1 386 PC is a high-quality system. It may be ordinary, but even the most ordinary 386 machine can be pretty amazing.

600EGA and a Taiwan-made Xtron Computer 14-inch EGA display with a tilt-swivel base. The monitor is stylish, compact, and of good quality. The video adapter duplicates all EGA modes and extends resolution up to 800 by 600 pixels.

The price of a full monochrome system with 512K bytes of RAM and 43-megabyte hard disk is \$2,940, making it the bargain machine of this group. The evaluation unit, with an 80387 coprocessor and EGA monitor and card, was \$4,580.

Although individual components of the system bear FCC Class B certification, the Micro 1 386 PC system unit itself lacked any FCC identification. That just about clinches it that this PC is exactly the kind of system you might put together yourself, but its high-quality components mean that

this would be a high-quality system. The Micro 1 386 PC may be ordinary, but even the most ordinary 386 machine can be pretty amazing.

NCR CORP.

NCR PC916

Compared with the coterie of clone makers, NCR Corp. has always gone a bit further in originality—if not marching to the beat of a different drummer, at least finding new and different cadences. Remember the Model 4 combined system unit and monitor? The PC916 brings the same refreshing spirit to the realm of high-performance 80386-based PCs.

Certain design elements of the NCR PC916 follow the standard AT design school, and of course, its faithfulness to PC compatibility is beyond reproach—but the cosmetics and implementation of the PC916 show a wonderful freshness combined with top performance.

PAYING FOR SPEED NCR is among the first manufacturers to eschew Band-Aid-type solutions to getting memory up to the speed of the 80386—biting the bullet and buying memory that matches the microprocessor for speed. The German-made PC916 uses 70-nanosecond dynamic RAM chips that allow the 80386 microprocessor to rip along at a full 16 MHz without wait states.

The speed of the PC916 is entirely programmable, however, and NCR supplies a software utility that allows user selection of operating speed from 2.65 MHz all the way up to top speed. It also allows the option of full-speed operation with the expansion bus running at 8 MHz or at a speed that matches that of the microprocessor.

The design of the PC916 differs from most in that it is a bus-oriented computer and does not have a true system board. Attached to the chassis is but a small printed circuit board holding little more than six AT-style, 16-bit bus connectors and two 8-bit connectors, all attached in parallel.

The bus-oriented design makes the PC916 amazingly upgradable. Pull out one board and plug in another, and the computer can change its demeanor entirely—from 80286 to 80386, potentially from 16 MHz to 20 or 25 MHz—all while

maintaining most of your hardware investment. It could even be converted into a 68000-based computer with equal adeptness.

The brains of the PC916, including space for either an 80287 or 80387 numeric coprocessor, are crammed onto a single expansion board that fills one slot. At least one additional slot must contain a memory board, and the standard NCR memory board is equipped with 2 megabytes of lightning-fast DRAM. Both boards make heavy use of surface-mount components to save space.

Besides the 16-bit bus, the microprocessor board and the memory board are linked by a tiny bus-extender circuit card that stretches the link to a full 32-bits wide. Although the bus extender in the evaluation machine linked only two slots, other models are offered that allow up to four 32-bit boards to be interconnected inside the PC916.

A third expansion card, the Personality Board, is also standard equipment. The personality that it gives the system includes a serial and a parallel port, as well as a floppy and a hard disk controller. (The real personality of the system, its NCR ROM BIOS, is part of the microprocessor board.)

A video adapter daughtercard also attaches atop the Personality Board. In the evaluation system, this adapter provided EGA-compatible signals using the Para-



EDITOR'S
CHOICE

FACT FILE

NCR PC916

NCR Corp.
1700 S. Patterson Blvd.
Dayton, OH 45479
(513) 445-2078

List Price: With 2 Mbytes RAM, 1.2-Mbyte floppy disk drive, 30-Mbyte hard disk, \$6,353; with 44-Mbyte hard disk, \$6,553; with 70-Mbyte hard disk, \$7,553; with 115-Mbyte hard disk, \$8,653; EGA monitor and card, \$745.

In Short: The NCR PC916 wins the Editor's Choice in this group for its outstanding workmanship and superior upgradability. It's as expensive as the Compaq Deskpro 386 or the IBM PS/2 Model 80, but if you can afford it, it's worth every cent.

CIRCLE 667 ON READER SERVICE CARD

dise Systems VLSI chip as a foundation.

Connectors for the serial and parallel ports—AT-style male DB-9 and female DB-25—are installed on the Personality Card retaining bracket. The EGA video

connector is bolted directly to the chassis with a short, braid-shielded lead connecting it to the adapter. The keyboard connector, on the rear panel, is attached to the bus board.



The Editor's Choice NCR PC916 achieves 16-MHz, no-wait-state performance that makes it one of the speed leaders among its competition. Fit and finish on the machine are unsurpassed, and excellent upgradability guarantees it a long future. Outstanding quality costs, however. A fully configured PC916 will require a \$7,000 to \$8,000 investment.

Apart from the bus-oriented design, the layout of the PC916 chassis is conventional, allowing the installation of the same drive options as an ordinary AT. On the right, two half-height bays are allowed front-panel access with an additional blind half-height bay below. Hidden inside is a single full-height bay, adaptable to two half-height devices. Power for the system is provided by a dual-voltage (115- or 230-volt AC) 220-watt supply in the right-rear corner of the chassis. Nearby, a small battery pack for the CMOS configuration memory and continuously running clock attaches inside the rear panel with a plastic hook-and-loop fastening material.

The standard filling for the first disk drive bay can be either a 5¼-inch high-density drive or a 1.44-megabyte 3½-inch drive. A number of hard disk options are available, including the fast but noisy Maxtor 70-megabyte unit in the evaluation machine.

The cabling and interconnections inside the chassis show the neatest workmanship of nearly any personal computer. With the flair and forethought of the service staff of a four-star hotel, NCR even includes such amenities as drive-mounting hardware in a neat package attached to the disk drives and snaps to hold loose power-supply connectors in place.

BEST APPROACH The exterior styling of the PC916 deserves particular commendation for being perhaps the best approach yet to traditional AT packaging. The rear panel is dressed up with an easily removable (it uses the same hook-and-loop material as the battery holder) plastic fascia, which covers all unused chassis cutouts with break-off panels and allows only the expansion slots, sockets in use, and the power-in and switched monitor power-output jacks to show.

The front panel is uncluttered, courtesy of a door hiding many of the details. Only the orange rocker switch that controls system power and two LEDs—power-on and drive activity—are visible. Pop open the door, and you'll find the case-and-keyboard lock and a speaker volume control. On some models, a smoked plastic sliding door covers the floppy disk drive slots. The same chassis is adaptable to desktop and desktide tower installation.

HOW TO B

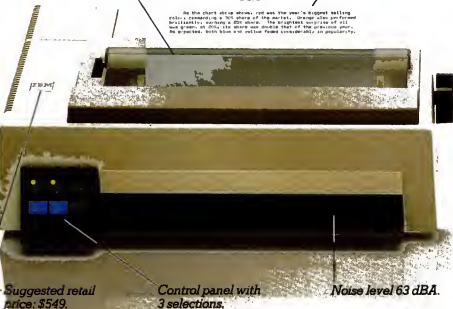
MARKET SHARE BY COLOR



9-pin printhead prints black and white only.

Top speed 200 cps for drafts, 40 cps for letter quality text.

As the chart above shows, red was the year's biggest selling color, commanding a 30% share of the market. Orange also performed brilliantly, earning a 25% share. The brightest surprise of all was green, at 20%, its share was double that of the previous year. As expected, both blue and yellow found considerably less popularity.



Suggested retail price: \$549.

Control panel with 3 selections.

Noise level 63 dBA.

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Because the ALQ200 has more of what it takes to get more done.

Take speed, for instance. With its 18- or 24-pin printhead, the ALQ200 prints excellent letter quality text twice as fast.

And the same is true for high

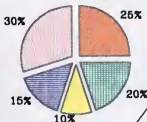
resolution graphics. Where, as you can see, we also have a distinct color advantage.

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MARKET SHARE BY COLOR



Top speed 240 cps for drafts, 100 cps for letter quality text.

As the chart above shows, red was the year's biggest selling color, commanding a 30% share of the market. Orange also performed well, earning a 25% share. The top green supplier of all was green, at 20%. The other two shades of red of the previous year. As expected, with blue and yellow being considerably in popularity.

ALPS ALQ200

Suggested retail price: \$595 for 18-pin, \$695 for 24-pin.

Push-button panel controls all printing functions without DIP switches or software commands.

Noise level 55 dBA.

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CIRCLE 242 ON READER SERVICE CARD

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ATTENTION TO DETAIL

With so many 80386-based PCs already on the market and many more inevitably on the way, manufacturers have begun to realize that speed alone will not maintain demand forever. Quality construction and thoughtful design are always in style, and when you are considering a \$5,000 to \$8,000 investment, you should expect a system without shortcuts.

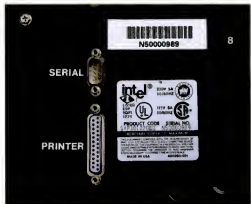
When shopping for an 80386-based system, you should define your needs and then seek out the machine that satisfies them best. Below are four examples of the types of details you might be looking for when you examine your options in this crowded and rapidly growing market. Careful shopping is a must with so much money on the line.



The keyboard of the Wang 380 is an old friend to people brought into the world of PCs on Wang equipment, but it will seem a little quirky to those used to IBM standards.



The NCR PC916's front-panel controls are hidden behind a sleek door that snaps shut, leaving the power switch accessible. The unit can stand as a tower or remain on the desktop.



The Osicom 386 includes a nice touch that even power users will appreciate: labeled ports and slots. Everything on the rear panel is tagged; note slot number 8 at the upper right.



The Micro 1 386 PC includes three externally accessible drive bays on the right side of its front panel. You may not need all of them at first, but they are there in case you ever do.

The NCR keyboard is one of the few truly successful variations on the IBM theme. Its basic layout conforms to that of the original AT design—enlarged Enter key, ten left-hand function keys and all—but it has been augmented by slipping an Enhanced Keyboard—style control pad in between the alphanumeric keys and the numeric keypad. The cursor keys on this addition are arranged in the shape of a plus sign rather than IBM's inverted "T." Also, NCR adds 20 extra programmable function keys in four banks across the top of the keyboard. Locking Shift keys have their indicator lights built into them.

Although the NCR keyboard lacks a true over-center feel, key pressure is progressive and the touch is light and very quiet. The keyboard itself is quite light. Although very different from the IBM in design, the NCR keyboard is easy and satisfying to type on.

Included with the evaluation system was an NCR EGA display. Again it proved stylish—of the wide-plastic-bezel-around-the-screen design school—but somewhat bulky atop the PC916. A tilt-swivel base was not included. In addition to full EGA compatibility, the display also provides a text switch that forces the on-screen image to amber.

The evaluation system was priced at a hefty \$8,298, and unconfigured base units (which include 2 megabytes of RAM) start at \$6,353.

Overall, the NCR PC916 rates as an excellent computer. At the top of the 16-MHz 80386 performance class, it's both well made and good-looking. Its excellent upgradability and the reputation of its maker make it a formidable competitor and one of the best choices for an 80386-based PC.

OSICOM TECHNOLOGIES INC.

Osicom 386

In few endeavors is it wise to vary from the traditional approach of starting at the bottom and working your way up—swimming, perhaps, being one exception. Osicom Technologies has adopted the contrary approach, yet it seems bound to succeed. The company intends to introduce a full line of computers but has chosen to begin at the top with an 80386-based PC as its first product.

Madness has its methods, and here Osicom does not stray far from the rule. Building a competitive and compatible 80386 computer is simply easier—and more profitable—than producing low-powered

clones. The primary explanation is that so many machines are all based on the same system board (Intel's) that nearly everyone is playing with the same handicap. Osicom is right on par.



Osicom Technologies has started at the top, introducing an 80386-based machine as its first PC. The Osicom 386 distinguishes itself by offering superior-quality components assembled around an Intel motherboard. With a price of \$4,495, including a 40-megabyte hard disk, it lands in the middle of the 80386-based-PC price range.

■ 386 COMPUTERS

Central to the Osicom 386 is the same Intel 80386-based iSBC 386AT motherboard you'll find in a dozen or more high-powered PCs. Osicom goes even further, however. Even the system unit bears an Intel label on its FCC Class A approval notification sticker.

QUALITY COMPONENTS The choice of components pretty much defines the overall performance of the Osicom 386. Like other Intel-based systems, its 80386 roars along at 16 MHz, held back only by the equivalent of one wait state—its actual two-wait-state operation benefits from two-way memory interleaving. Performance can be toned down to an effective 8 MHz for problematic programs by burdening the microprocessor with more wait states. This speed shift is accomplished from the keyboard.

Similarly, system board memory consists of 512K bytes, all allocated to DOS, made from 16 120-nanosecond, 4K- by 64K-bit dynamic RAM chips. Two 32-bit expansion slots, also running at the 16-MHz rate, allow up to 16 megabytes of extended memory to be plugged in, while DOS memory can be fleshed out only by a 16-bit, 8-MHz, multiple-wait-state board in an AT-style expansion slot.

Included in the Intel system board circuitry are several additional features—one serial port, one parallel port, a clock/calendar, and CMOS configuration memory. The evaluation machine had a second parallel port on its monochrome video adapter card.

A socket is also available for adding a numeric coprocessor, a 10-MHz 80287 chip on a board called an SBCMATH module. Some (but not all) models can also accommodate an 80387.

The evaluation unit was equipped with the 80287 assembly. In testing, it proved almost exactly half as fast as units sporting 80387 coprocessors in similar Intel motherboards but many times quicker than those having no coprocessor at all.

Besides the two 32-bit slots, the Osicom 386 features four 16-bit and two 8-bit slots. The 32-bit slots can also be used with 8-bit cards, but in such applications they degrade from a clock speed of 16 MHz to the 8 MHz used by the other slots.

In the evaluation machine, one 16-bit



FACT FILE

Osicom 386

Osicom Technologies Inc.
198 Green Pond Rd.
Rockaway, NJ 07866
(201) 586-2550

List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, \$3,995; with 40-Mbyte hard disk, \$4,850; floor tower model, \$5,700; amber monitor and card, \$350; 2-Mbyte RAM expansion board, \$650.

In Short: The Osicom 386 is a particularly attractive machine that performs on a par with other Intel-motherboard-based 386 machines. Lacks FCC Class B certification.

CIRCLE 686 ON READER SERVICE CARD

slot was filled with an AT-style combined hard-and-floppy-disk controller and one 8-bit slot was given to a short monochrome video adapter. All expansion slots are full-length and AT-height.

The system is set up through software with a simple menu-driven program supplied by Osicom. It offers complete support of all standard floppy disk drives, including 3½-inch units as well as 47 different hard disk models. Several network adapters are also available directly from Osicom.

With the brain power of so many 80386-based machines so well matched, system integration and configuration are the biggest differences between models. Here the Osicom 386 does not disappoint. It's well made, offering impressive options, and—at the risk of being accused of falling for a pretty face—we have to say it's stylish.

Functionally, the front panel of the AT-size Osicom 386 matches nearly every engine of its ilk, equipped with power and drive activity indicators and a case-and-keyboard lock. Osicom, however, locates all exactly at the beltline and adjacent to each other on the left of the twin visible half-height drive bays, which are at the right of the system unit. The bottom of the lower bay marks a full-width chin where the base of the machine, sliced with ventilation slots on the front left, recedes about half an inch back from the balance of the panel. Another half-height bay is hidden under these two, but it can gain front-panel

access if you remove a blank panel that's sculpted to conform with the front contour of the machine. This panel is screwed in place and is much more secure than the snap-in blanks used by many machines.

Decorative as it is, the control panel fits exactly in front of the internal full-height drive bay and must be unscrewed to install a hard disk drive there—a bothersome but not fatal shortcoming.

Interestingly, particularly for an FCC Class A machine, the few wires going to the control panel are shielded with metal braid wherever they travel outside the chassis. Probably also as radio frequency interference protection, the hidden full-height drive bay and the visible bays are solidly caged completely around, except in the rear.

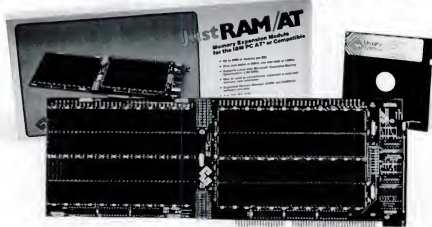
Behind these bays lies a 220-watt power supply that bears an Intel part number but is manufactured in Taiwan by Taepo Corp. Its operating voltage—either 115 or 230 volts AC—is set using a recessed external slide switch located on the rear of the chassis. Near the power supply inside the case is a large black lithium battery, screwed inside the rear panel, for keeping the CMOS memory and clock alive and well. While it is a secure arrangement, the screws and the unusual battery itself add to the bother of replacing it when necessary.

LABELLED SLOTS The rear panel ranks above average because all slots and connectors are plainly labeled in what looks like white dry-transfer lettering. Besides those in the expansion slots, there are connectors in back for the keyboard, the serial port (a male DB-9), one of the parallel ports (a female DB-25), incoming AC, and switched AC for the display. On the right side of the chassis is the typical big red paddle power switch.

A tower-style package with more drive options is also available.

Osicom offers its 386 bare except for a single 5¼-inch, high-density floppy disk drive; loaded with up to 192 megabytes worth of internal hard disk; or overcome by up to three additional hard disks. The base price is \$3,995. The evaluation unit was equipped with a Seagate ST251 half-height 40-megabyte drive configured with the Seagate proprietary version of On-track Computer System's *Disk Manager*

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CIRCLE 514 ON READER SERVICE CARD

■ 386 COMPUTERS

software. In addition, the system includes Osicom hard disk formatting and diagnostic software and a RAM-based floppy disk emulator. With the monochrome monitor provided, the evaluation system cost \$5,200.

Although the instructions described the system as using an AT-style, 84-key keyboard, the evaluation unit was equipped with a 101-key model that followed the IBM Enhanced Keyboard layout. Its touch offered some tactile feedback but no IBM-style click—a soft system unit noise was substituted. Although not the best keyboard in the world, it won't be a handicap in itself, as so many clone keyboards are.

Osicom included a Samsung MD-1278G Flat Monitor with the 386—a nice choice. Although the controls for the green monochrome screen required some tinkering to produce a picture, the results were worth it—the 12-inch screen is strangely flat in comparison with most displays. The very compact case, built-in tilt-swivel base, and attractive styling made the Samsung a pleasure to work on.

The Osicom 386 rates as an attractive unit, with typical 80386 performance backed by a vendor willing to customize multiuser systems with as much mass storage as any one system could reasonably expect to use. The mainstream price (\$4,495 with 40-megabyte hard disk) further adds to its attractiveness.

PC DESIGNS INC.

PC Designs GV-386

PC Designs has explored an array of avenues to increase the cost effectiveness of your PC purchase. The company began by offering a build-it-yourself PC that eliminated labor costs, then graduated to budget-priced, fully configured AT-compatible systems. The PC Designs GV-386 extends the more-for-your-money philosophy by packing more performance than that of the average 80386-based computer through the use of an interesting and different system board.

Made by Micro Design, the GV-386 system board is novel in its adaptation of memory caching to the system board itself, using a 64K-byte buffer to speed up memory access to all RAM within the 16-megabyte addressing range of the computer,

both system board and expansion memory. According to PC Designs, the buffer can boost processing speed by 83 percent over the base performance of the GV-386. The test results show that base perfor-

mance must be modest, because the GV-386 scores close to on a par with its competition (perhaps slightly faster) on most tasks.

Objectively, base performance means a



PC Designs, long a leader in price and performance, has another high-quality machine on its hands with the GV-386. This unit is one of the least expensive of all 80386-based PCs, but the only real trade-off is the system's inability to accept an 80387 math coprocessor and more than 4 megabytes of 32-bit memory. If this limited upgradability does not bother you, then the GV-386 is a machine worth considering.

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\$1,200*

QIC 286-10B Basic system

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■ 386 COMPUTERS

16-MHz system with two wait states when reading memory from the system board RAM, the wait states being necessary because of the 120-nanosecond chips used in the system. The choice of this rather slow memory appears to have been purposely made to allow maximum flexibility in choosing memory chips.

FLEXIBLE BOARD The system board takes advantage of that flexibility by allowing you to use either 64K-bit, 256K-bit, or 1-megabit memory chips to fill the 36 sockets provided on the system board. The different sizes can be combined to yield various intermediate capacities within the 256K-byte to 4-megabyte range of the board. One megabyte, realized with all sockets filled with 256K-bit chips, is standard and is functionally divided into 640K for DOS and 384K for extended memory.

The large system board memory capacity allows PC Designs to sidestep the issue of 32-bit expansion bus standardization. The GV-386 has no 32-bit expansion bus but instead packs all of its wide bus RAM on the system board itself.

Should you need more than 4 megabytes, you have to add RAM through the 16-bit slots of the GV-386. The buffer helps to prevent memory accesses from slowing down too much, but even PC Designs admits that accessing expansion memory is always going to be slower than using system board RAM.

As with most 80386-based PCs, the GV-386 expansion slots operate at 8 MHz. The clock speed of the microprocessor can also be reduced to 8 MHz for maximum software compatibility by selecting an alternate clock crystal on the system board. This selection is made by pressing a three-key combination. The boot-up speed of the system is determined by a DIP switch setting.

The memory buffer can also be defeated by pressing a four-key combination.

To increase performance further, the GV-386 provides an empty socket for an 80287 numeric coprocessor. The speed at which this chip operates can be selected as 6, 8, or 10 MHz. Even the DMA (direct memory access) speed is user-selectable.

All four ROM sockets on the system board are filled with chips, and the BIOS they contain bears the copyright of Ameri-



FACT FILE

PC Designs GV-386

PC Designs Inc.
2500 North Hemlock Circle
Broken Arrow, OK 74012
(918) 251-5550

List Price: With 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, 40-Mbyte hard disk, \$3,125; monochrome monitor and card, \$279; EGA monitor and card, \$844

In Short: The PC Designs GV-386 is one of the lower-priced 386 machines, but its quality is very good, its only drawback is its potentially limited upgradability.

CIRCLE 685 ON READER SERVICE CARD

can Megatrends. The system setup program—a simple, query-driven affair—is also built into the ROM.

The BIOS evidenced no apparent incompatibilities, but even if it does, PC Designs protects you with a unique compatibility guarantee. If the company's reasonable efforts to resolve compatibility problems aren't successful within 30 days, PC Designs will refund your purchase price—in exchange for the return of the machine, of course.

The rest of the GV-386 matches standard AT practice. Eight full-length, AT-height expansion slots are provided—six equipped with a 16-bit data bus, two with an 8-bit bus.

According to PC Designs, three of these slots are filled in the standard GV-386 system. One 16-bit slot is devoted to a Western Digital WD1003 combined hard-and-floppy-disk controller, while an Everex Magic I/O card and a video adapter fill the two 8-bit slots. The evaluation machine was not equipped with a video adapter, however.

The Magic I/O adds one parallel port and two serial ports to the standard equipment of the GV-386. On the retaining bracket of this card are the female DB-25 connector of the parallel port and a male DB-9 for the first serial port. A male DB-25 for the second serial port, plainly labeled as such, is located in a cutout in the rear panel of the chassis.

The chassis holds one internal full-height hard disk drive bay with three half-height bays on its right, all three of which

have possible front-panel access. Standard configuration puts one 5¼-inch, high-density floppy disk drive in the top slot and a Priam 1D-40 hard disk in the internal bay. The price for the basic system is \$3,125.

The evaluation unit's drive was preformatted for DOS (but without system files), and its 40-megabyte capacity was split into two DOS volumes using software provided by Priam. The quick 26-millisecond average access time of the drive proved to be a good complement to the performance of the 80386.

Upper left on the GV-386 is the usual AT control panel. However, PC Designs adds a system reset switch to the expected case-and-keyboard keylock and power and drive activity indicators.

The Astec power supply of the GV-386 is capable of delivering 220 watts and will operate at either 115 or 230 volts AC, selectable by a recessed DIP switch on the rear panel. In addition to the power input connector, a switched outlet is available for a monitor. The power switch is the standard big red paddle on the right side of the computer.

As with most AT compatibles, the GV-386 includes a built-in continuously running clock and a CMOS configuration memory. A pack of four AA batteries attached to the power supply keeps this memory fresh. Configuration memory is supplemented by a wealth of jumpers and a bank of DIP switches on the system board.

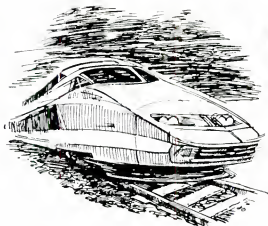
PC Designs supplies a 101-key Maxi-Switch keyboard patterned after the IBM Enhanced Keyboard design. Although its rubber dome technology is decidedly different in feel from that used by IBM and gives no audible feedback, its good snap-over tactile feedback makes it a pleasant keyboard to type upon. PC Designs' inclusion of extra keycaps (so that the left-hand Ctrl and CapsLock keys can be switched) will be welcomed by anyone who regularly types Ctrl-key combinations.

WORKMANSHIP The GV-386 goes beyond the typical budget machine in many areas. Workmanship is above average, and the interior of the machine is not tied up with a snarl of ribbon cable. The documentation is clearly written, lengthy, and in-depth. And PC Designs also includes a software bonus to make the fea-



**EDITOR'S
CHOICE**

GV-286 "It coaxes extraordinary performance through the use of imaginative design and careful engineering."
October 13, 1987



PC WEEK

GV-386 "the performance is the best we have found to date." May 26, 1987

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- And much more
- Starting at \$1,425

GV-286 Model 120

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GV-386

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■ 386 COMPUTERS

tures of the 80386 microprocessor useful in the guise of the *DESQview* multitasking operating environment. According to the documentation, the system is FCC Class B rated, but no compliance sticker was visible on the evaluation unit.

Although the machine is both accessible and usable by the novice, it offers its greatest benefits to the more experienced user—the one not afraid of swapping RAM chips and tinkering with the controls to customize the operation of the system. Its weaknesses are its inability to accept an 80387 and to expand beyond 4 megabytes of top-speed 32-bit memory (or beyond 1 megabyte without still-rare 1-megabit memory chips).

For a single-user system not running number-intensive operations (such as computer-aided design), those limitations should not be burdensome—at least until you want to run 16 simultaneous tasks.

TELEVIDEO SYSTEMS INC.

TeleVideo Tele/386

For a terminal manufacturer to make a multiuser computer is as inspired as, say, for a toothpaste company to sell candy. The availability of one should create a need for the other, and the two endeavors will cross-pollinate wonderfully.

TeleVideo Systems, one of the world's largest terminal manufacturers, got the idea long ago and created multiuser systems based on the 80286 microprocessor (in addition to single-user PCs). The TeleVideo Tele/386 takes the next technical step, yielding a fast, powerful 80386 computer equally suited to single-user and multiuser applications.

OUTWARD RESEMBLANCE As with most 80386-based top-of-the-line successors to 80286 machines, the Tele/386 bears a strong outward resemblance to its predecessor and, internally, resembles most AT compatibles. It wears the same gray face as earlier TeleVideos, with an unusual angular sweep flowing into the two visible over-and-under half-height disk drive bays. As with the AT, the other half-height bay lies hidden below, and to the left are two more.

On the upper left is the expected miniature control panel complete with case-and-

keyboard keylock and power and drive activity indicators. TeleVideo, however, supplements these with a cylindrical system-reset push button. Near the lower-left corner is a keyboard jack, duplicating the

function of another on the rear panel.

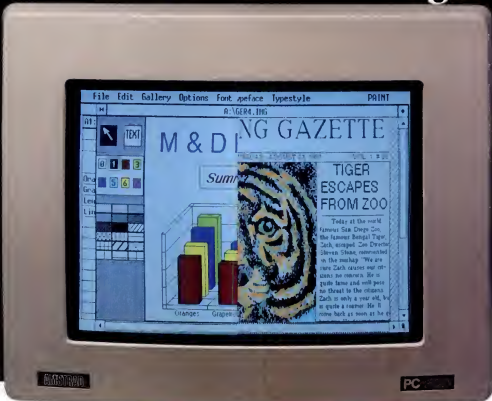
Also at the aft end of the sturdy steel case are a male DB-9 and a female DB-25 connector for the standard equipment serial and parallel ports, located almost amid-



The TeleVideo Tele/386 comes from a company long associated with terminals, several of which can be hooked up to this machine when it's configured as a file server. Standard equipment includes 2 megabytes of RAM, as well as a floppy disk drive and a 40-megabyte hard disk. The proprietary controller card also has the capability to handle a tape backup unit.

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CIRCLE 303 ON READER SERVICE CARD

ships of the bottom of the rear panel. The system accommodates up to a total of seven serial and three parallel ports.

On the starboard side (viewed from the bow) are the expected electrical connectors: power-in and switched current to run a display. Hidden next to the former is a small black rocker switch for turning the machine on and off. Although this is hard to see, it's easy to grope around and find it, using the power cord as guidance.

A nearby recessed switch allows the selection of either 115- or 230-volt AC electricity to run the 220-watt power supply. An input power fuse can be accessed from the rear panel and replaced, if necessary, by the user without having to disassemble the system.

The system board inside the Tele/386 is an original effort, unusual in the absence of the proliferative Chips and Technologies components upon which so many such machines are based. TeleVideo relies heavily on discrete circuitry and engineering to ensure PC compatibility. As a result, however, the board is large, even though it's devoid of memory.

The 80386 and a socket (which accommodates either an 80387 or a special adapter containing a 10-MHz 80287) reside in an easily accessible area almost dead-center on the system board. The microprocessor runs at its rated 16 MHz, and although the memory board is supposed to be zero wait state, it turns in performance almost identical to the original Compaq Deskpro 386 with its 0.8-wait-state rating.

All system memory is held on expansion boards that slide into the system's two 32-bit slots. Memory boards with 2- and 8-megabyte capacities are available, allowing system configurations of 2, 4, 8, 10, or 16 megabytes.

The standard system has a single 2-megabyte board installed in one 32-bit slot. The first 640K bytes of the first megabyte is consigned to DOS; the rest of that megabyte is unused, according to TeleVideo documentation. The balance serves as extended memory.

According to TeleVideo, the Tele/386 is not compatible with EMS or EEMS memory boards, although it will accommodate 16-bit boards that allow the proper address assignments. In addition, the evaluation Tele/386 proved compatible with EMS/EEMS emulated through software drivers.

The system board also includes five 16-bit expansion slots and a single 8-bit slot for installing options. The 8-bit slot is best reserved for the video adapter (an extrawide 8-bit board with a "skirt" that drops down below connector level), as this slot is the only one that will accommodate it. In normal system configurations, TeleVideo puts the video adapter in this slot.

TAPE DRIVE OPTION One 16-bit slot is used by the proprietary disk controller board. Besides running a hard disk and floppy disk, this board also accommodates a high-capacity, high-speed cassette tape backup system. The tape drive itself is optional. This board is also capable of operating either ST506 or ESDI interfaced hard disks. In addition, the TeleVideo controller normally formats hard disks (using software provided with the system) with a 1-to-1 sector interleave.

The standard floppy disk drive, installed in the upper disk drive bay, is a high-density, 5 $\frac{1}{4}$ -inch unit. The hard disk in the evaluation unit was a 43-megabyte Microscience HH-1050, an ST506 drive that proved to have an average access time of 33 milliseconds. The total cost of the evaluation system came to \$5,749.

The requisite CMOS configuration memory includes settings for 32 different hard disk types, including 12 ESDI arrangements. An AT-style clock/calendar is also built into the system, kept alive by a

battery. The TeleVideo design allows the use of two different batteries, one of 7.3 volts and one of 3.6 volts. The two battery types plug into separate system board connectors.

The keyboard accompanying the evaluation unit followed the IBM 101-key Enhanced Keyboard design. Alternatively, one with the original AT key arrangement is also available. The Thai-made keyboard proved to be a disappointment, however, with a shaky, no-feedback touch and no audible feedback. It's workable but could use improvement.

TeleVideo offers a variety of video systems with the Tele/386, patterned after the various video standards. The minimal system is a monochrome display and adapter. The evaluation system was equipped with an EGA adapter and display.

That adapter, unlike the Tele/386 itself, is based on the Chips and Technologies EGA chip set and is compatible with all EGA modes. Although bulky compared with some sleek modern designs, the TeleVideo EGA monitor displays a sharp, bright picture on a par with industry standards and includes a text-mode push button that turns the screen green.

The Tele/386 arrived complete with MS-DOS 3.21, GW-BASIC, and substantial, reasonably clear documentation. It's a good, solid machine that should be up to any business challenge.

WANG LABORATORIES INC.

Wang 380

Moving from office automation to mainstream computing has been a difficult journey for Wang Laboratories, but the latest reports put the long trek finally on track. A prime example of the change and development of the Wang product lineup is the 80386-based Wang 380, the company's top-of-the-line desktop model.

While earlier Wang efforts have combined MS-DOS and minicomputer technologies with varying degrees of IBM compatibility and success, the Wang 380 (and its 80286 siblings that share its case design) meets the IBM standard as well as nearly any machine on the market. And well it should with its Phoenix Technologies BIOS and Intel iSBX 386AT motherboard.



FACT FILE

TeleVideo Tele/386

TeleVideo Systems Inc.
1170 Morse Ave.
Sunnyvale, CA 94088
(408) 745-7760

List Price: Model 40 with 2 Mbytes RAM, 1.2-Mbyte floppy disk drive, 40-Mbyte hard disk, \$4,899; 2-Mbyte RAM expansion board, \$995; EGA monitor and card, \$850.

In Short: A famous manufacturer of terminals creates a machine to hook them up to. The TeleVideo Tele/386 is a strong performer that will work equally well as a single-user or multiuser computer.

CIRCLE 664 ON READER SERVICE CARD

TRANSITIONAL MACHINE What makes the Wang 380 stand out from the rest of the 80386-based PCs on the market is its status as a transitional machine, for both the company and its customers. It will

help both venture into the realm of 80386 power and PC compatibility without giving up the support, service, and finger interface of Wang.

The Intel motherboard defines the per-

formance of the Wang 380 with its 16-MHz clock tempered by one wait state. Two-way memory interleaving cuts the two wait states in RAM reads required by the 120-nanosecond 4K- by 64K-bit chips used for motherboard memory. Wang extends the 512K bytes on the motherboard through a standard 2-megabyte expansion board addition, with other options allowing up to 16 megabytes on the 32-bit data path expansion bus.

Alternatively, the native memory endowment of the Wang 380 can be supplemented with 16-bit memory boards, which will impose performance penalties. This

■ What makes the Wang 380 stand out from the rest of the 386 PCs on the market is its status as a transitional machine.

16-bit memory must be used to increase the 512K bytes allotted to DOS to a full 640K.

To make the standard 2 megabytes of extended memory more useful, Wang includes both EMS and EEMS drivers with the Wang 380.

From the keyboard, performance can be degraded to the equivalent of 8 MHz by pressing a three-key combination. Performance on number-intensive chores can be improved through supplementing the 80386 microprocessor, which is achieved by plugging a small daughtercard containing a 10-MHz 80287 into a vacant socket on the motherboard.

Although nine retaining brackets are visible from the rear of the Wang 380, only eight slots are functional inside the chassis. The other bracket is just a slot filler, but it may prove a valuable addition that allows the mounting of extra connectors, such as for a flock of serial ports for external terminals or other peripherals.

Two slots are limited to an 8-bit bus, four to 16 bits, and two can handle a 32-bit data path or most 8-bit cards. Only 32-bit



The Wang 380 will find its niche as a Wang-to-DOS compatibility bridge in companies that have a heavy investment in Wang hardware. Though the machine is fully DOS compatible, shadows of a proprietary past are still visible, especially in the keyboard. Nevertheless, the Wang 380 comes with a wide variety of software, and the system's quality is very high. For those who can foot the \$8,000 bill, the Wang may be a good business solution.

■ 386 COMPUTERS

connections operate at full clock speed; 16-bit and 8-bit slots (including 32-bit slots filled with 8-bit boards) are limited to 8-MHz operation.

Standard equipment from Wang fills three of the slots. One with an 8-bit data bus is optionally equipped with Wang's proprietary Multimode Video Controller, which supports all popular video standards up to EGA-level, including MDA, Hercules Graphics, and CGA. One 16-bit slot is filled with a Wang combined hard disk, floppy disk, and tape controller.

A 6-volt Sanyo lithium battery, attached inside the rear panel with hook-and-loop plastic fasteners, provides continuous power to the clock and CMOS configuration memory of the Wang 380.

Although the Wang 380 is functionally a conformist, its styling deviates from the IBM standard. The entire case, including the front-panel bezel, is finished in a battleship gray. The bottom of the bezel folds down around the case into two runners that serve as feet, adding to the impression of sturdiness given by the machine. A bent-rod adapter base is available for converting the Wang 380 to vertical, desk-side operation.

Instead of IBM gray-beige, the front of the standard 1.2-megabyte 5¼-inch floppy disk drive in the topmost of the three visible rightside disk drive bays is black;

the other two are filled with blank panels of gray plastic that match the bezel.

Inside the case is a single full-height hard disk drive bay that can be filled by Wang with drives of between 20 and 68 megabytes. The evaluation unit was equipped with an ST506-interfaced 44-megabyte Micropolis drive with a fast average access time of about 28 milliseconds.

Wang has made the installation of drives an easy, tool-free affair for the Wang 380, much as it is for IBM's PS/2 line. All its disk drives are held in place by special guide rails that have end tabs that automatically latch the drives in place without the need for screws. To remove a drive, just press the tabs inward, and you can pull out the drive. You still must connect the cables to the drive in the normal way, however.

To the right of the top floppy disk drive bay, near the center of the front panel, are the principal controls: from left to right, a flat-key case-and-keyboard lock, power and drive activity indicators, and a large rectangular push-on/push-off power switch. Strangely, while pressing this button controls the power to the Wang 380 proper, it does not affect the current flow to the monitor power jack at the rear of the machine.

The rear of the system unit is covered by a decorative plastic panel that's attached with the same screws holding the top of the case on. Cutouts in this panel allow access to the expansion slots, power-supply connectors, and male DB-9 and female DB-25 of the standard equipment serial port and parallel port.

Perhaps the oddest feature of the back of the Wang 380 is the keyboard connector. A jack at the expected place, near the bottom of the chassis, is filled with a plug, the cable of which leads back inside the chassis and terminates in a second keyboard connector about 3 inches above the first. This arrangement serves to route extra current to the keyboard, as the second connector is also linked directly to the power supply.

BUNDLED SOFTWARE Wang bundles MS-DOS 3.2, *Microsoft Windows* (including *Windows Write*), partitioning software, memory device drivers, a tutori-

al program, and diagnostics with the Wang 380. Wang's *System Services* shell and *Word Processing Software* are available as options.

Anyone familiar with any IBM personal computer will likely regard the Wang keyboard as an aberration, but Wang users will find it an old friend. The arrangement of functional blocks of keys conforms to the general scheme of the IBM Enhanced Keyboard, but the legends on individual

PC EDITOR'S CHOICE

• NCR PC916

The speed leader among these newest 80386-based PCs is clearly NCR Corp.'s PC916. It also rates highly for its innovative design, styling, and execution. In fact, it earns higher honors than even the original 16-MHz Compaq Deskpro 386.

Compared with the first batch of 80386-based PCs we evaluated, the NCR PC916 does amazingly well, too. While the IBM PS/2 Model 80 remains the overall leader, the NCR PC916 pulls in just behind the PC's Limited 386-16 in terms of performance and execution (the PC's Limited wins the 16-MHz race because its zero-wait-state static RAM needs no refresh time). If speed is your major concern, though, the new Compaq Deskpro 386/20 blows every other 386 machine away.

Nevertheless, the NCR PC916 rates among the fastest and best desktop computers ever made, and that's high praise indeed. With a 30-megabyte hard disk system priced at over \$6,300 and a 70-megabyte EGA system at about \$8,300, NCR's machine is on a par with the 16-MHz Compaq Deskpro 386 and about \$600 cheaper than a similarly equipped IBM PS/2 Model 80. Clearly, NCR is after the big spenders, and the quality of its product should ensure it a fair share of that market.



FACT FILE

Wang 380

Wang Laboratories Inc.
One Industrial Ave.
Lowell, MA 01851
(800) 225-4627
(617) 459-5000

List Price: Model 380-1 with 512K RAM, 2-Mbyte RAM expansion card, 1.2-Mbyte floppy disk drive, \$6,495; Model 380-2 with 42-Mbyte hard disk, \$7,695; Model 380-3 with 68-Mbyte hard disk, \$8,495; high-resolution monochrome monitor, \$250; multi-sync EGA monitor, \$950.

In Short: The Wang 380 successfully bridges the gap between the Wang standards of the past and the DOS standards of today. Its high price destines this machine for Wang-based offices rather than for homes and single users. Lacks FCC Class B certification.

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keys vary widely from their IBM nomenclature. For instance, you'll find a dedicated Help key to the right of the top row of 16 function keys—a row that ends with a Cancel key. Ctrl and Alt are relegated to miniature-key status flanking the Spacebar, and you'll find such additions as Exec and GL (which stands for glossary). The oddities are actually valuable additions to the Wang software family that has delighted office workers for a decade.

Although about the same size, the Wang keyboard itself is lighter than its IBM equivalent yet has an equally solid feel. The feel is light but stiff, with genuine over-center tactile feedback. Although the

■ With configured machines running over \$8,000, the likely purchasers of the Wang 380 will be Wang's loyal corporate customers.

key action is quiet in itself, a speaker in the keyboard can peep out audible feedback with each key press. A volume control on the bottom of the keyboard determines exactly how much feedback you get.

The Wang enhanced monitor goes beyond the EGA standard and accepts analog as well as TTL inputs. It also features size and position controls, along with brightness and contrast—all hidden behind the right side of the front bezel.

With configured machines running over \$8,000 (the evaluation unit was priced at \$8,645), the likely purchasers of the Wang 380 will be Wang's loyal corporate customers. Its FCC Class A rating for business and its price will be a disincentive to individual purchasers, particularly considering that the same underlying components are available from other sources for a much smaller expenditure.

Winn L. Rosch is a contributing editor of PC Magazine.

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*InfoWorld, September 14, 1987, Page 66-70

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TSR Notes to Yourself



Entropy—the tendency of the universe toward disarray—applies at least as much to information as it does to galaxies. We all generate countless little bits of information, from do-lists to comments about spreadsheet cells. Keeping that information organized enough to be useful can seem like an entire job description unto itself. Of course, our PCs are supposed to keep us organized, but the three major software types—word processors, databases, and spreadsheets—all fall short when it comes to keeping track of random facts, quick notes, and other informational minutiae.

SideKick, the granddaddy of all TSR (Terminate and Stay Resident) utilities, was a step in the right direction. *SideKick*'s pop-up notepad lets users jot down a quick note or take a phone message without leaving their current application. Since it is memory resident, *SideKick*'s notepad can be instantly accessed and used to store that brilliant insight that would otherwise have been lost. The idea caught on. There are now more than a dozen *SideKick* competitors. (See our roundup, "TSR Desktop Organizers: More Features, Fewer Conflicts," *PC Magazine*, Volume 6 Number 14.)

Good as it was, and is, *SideKick*'s notepad lacked some of the

Be it note-taker or note-attacher, these memory-resident pop-ups help jog your memory, find bits of information, or insert a comment when and where you need it most.



■ TSR NOTE-TAKERS

features that solid information organization demands. An emerging class of software is aimed at keeping notes, scribbles, and random comments at your fingertips. These pop-up note-takers, the subject of this review, range in price from \$49.95 to \$79.95 and fall into two basic categories—those that are essentially memory-resident scratch pads (similar to *SideKick's* notepad) and those that let you attach notes, as you write them, to other applications.

Micro Logic Corp.'s \$49.95 *Tornado*, formerly *Tornado Notes*, and Broderbund Software's \$69.95 *MemoryMate* fall into the first category. You can hotkey into these memory-resident scratch pads from any application or from DOS. They present you with a blank sheet of electronic "paper," ready to record whatever is on your mind. The programs index each word in your notes and store them in a file that can be searched. Since all notes are fully indexed, they can be retrieved by invoking any unique word or phrase that appears in the note you are looking for.

The other category of pop-up note-takers was spawned when Turner Hall Publishing introduced *Note-It* in July 1985. The first version of *Note-It* let you annotate 1-2-3 worksheet cells by attaching electronic "Post-its" to the cells. Because pop-up annotation programs actually link to the underlying structure to attach the notes, David Whitney, *Note-It's* author, just about had to disassemble 1-2-3, Release 1A, to figure out how to attach the notes to the worksheet's cells.

ADDING FEATURES Personics Corp. released *SmartNotes* early in 1986. *SmartNotes*, at \$79.95, took the idea of annotation even further by allowing you to attach notes to nearly any application or DOS directory filename. The latest version of this program, released this summer, adds even more features to an already ingenious program. *SmartNotes* takes a slightly different approach to attaching notes. It takes a "picture" of the screen and uses a sophisticated pattern-matching technique to determine where a note is attached.

Computer Associates' \$49.95 *Cell Note*, like the original *Note-It*, is a RAM-resident program that attaches notes to 1-2-3. *Note-It Plus*, the most recent version of

Note-It, and *Noteworthy*, from Funk Software, take advantage of the Lotus Developer's Tools available in 1-2-3, Release 2.x. Both list for \$79.95 and make use of the Lotus Add-in Manager to integrate their programs more closely with 1-2-3. Since the developers of such programs don't have to work around 1-2-3, they can work with the program and direct their efforts toward giving users more features.

Cell annotation could simplify life for those who share spreadsheet models. The person who builds the 1-2-3 spreadsheet makes numerous assumptions in creating formulas and defining relationships among cells. Those formulas and relationships may be clear to them, but aren't necessarily so to others who must use the same model.

It's the same old programmer's nightmare: dealing with undocumented code written by someone long gone. Cell annotators allow explicit comments to support each twist and turn in a spreadsheet model, in much the same way that comments limit the way for programmers who must work with someone else's code.

Cell Note

Computer Associates' \$49.95 program *Cell Note* attaches notes to 1-2-3, *Symphony*, and *The Spreadsheet Auditor* worksheets. Because *Cell Note* does not use the Lotus Add-in Manager to attach notes to worksheets, it can also be used with 1-2-3, Release 1.x.

If you know Computer Associates as the company that makes *SuperCalc4* and are wondering why *Cell Note* attaches notes to 1-2-3 rather than *SuperCalc4* worksheets, last year Computer Associates acquired both *Cell Note* and *The Spreadsheet Auditor* from Consumers Software. At the same time, the company announced its goal of offering a complete line of products for increased worksheet functionality for both 1-2-3 and *SuperCalc4*. And by the time you read this, Computer Associates will have a version of *Cell Note* available for *SuperCalc4*, as well as several other spreadsheet productivity products for 1-2-3 and *SuperCalc4*.

Cell Note lets you attach a note of up to 500 characters to any cell, and you can attach a total of 200 notes to the worksheet.



FACT FILE



Cell Note,
Version 1.06
Computer Associates
2195 Fortune Dr.
San Jose, CA 95131
(800) 533-2070
(408) 432-1727

List Price: \$49.95. (The

Spreadsheet Auditor includes *Cell Note* and *Macro Analyzer* bundled for \$99; *Snap Tools* includes *Cell Note* in a package of five utilities bundled for \$149.)

Requires: 256K RAM (512K RAM recommended); 1-2-3, Release 1.x or 2.x, *Symphony*, or *The Spreadsheet Auditor*; two disk drives; DOS 2.0 or later.

In Short: A RAM-resident program that lets you annotate 1-2-3, Release 1.x or 2.x, *Symphony*, or *The Spreadsheet Auditor* worksheets. *Cell Note* allows you to sort your cell notes by certain cell designations and to attach notes to spreadsheet filenames as well as to cells. Not copy protected.

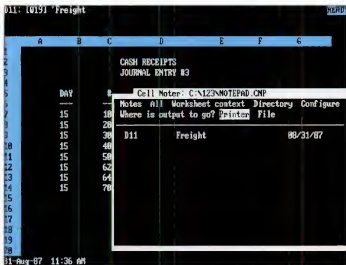
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All the notes for a worksheet are stored in a file that uses the name of the worksheet, followed by a .CNP extension. You can also attach a note to a worksheet filename. These notes are referred to as file notes (as opposed to cell notes) and are stored in a file with an .FNP extension.

DISK CONSUMPTION Although *Cell Note* requires only 28K bytes of RAM in addition to 1-2-3, a CNP note file with only one note takes up nearly 5K bytes of disk space. This is considerably more than either *Noteworthy* or *Note-It Plus*. Before you attempt to create notes for a worksheet, make sure you have enough disk space for the number of notes you estimate you will need to document the worksheet.

The hotkey used to invoke *Cell Note* is the Alt-F1 combination. If you want to change the hotkey, you have the option of using a combination of Alt, Shift, or Ctrl and another key of your choice. You can also change the activation key used to highlight cells that have notes attached.

The notepad that you pop up to annotate a cell includes the date (if your computer doesn't have a clock, *Cell Note* allows you to set the date), the name of the file in



Among other print features, Cell Noter lets you choose from a list of annotated cells when you decide to print your cell notes.

■ **Cell Noter** lets you attach a note of up to 500 characters to any cell, and you can attach 200 notes to the worksheet.

which the note will be stored, the cell location, and the first eight characters in the cell.

Since the notepad covers a large portion of your worksheet, you may find the notepad is in your way. To reveal the worksheet without leaving *Cell Noter*, press the F2 key to temporarily remove it from the screen. You can bring it back by pressing any key.

Whenever you edit a note, *Cell Noter* asks if you want to keep the changes you have made. If you want your edits to be saved automatically, you can suppress this prompt. You can move or copy notes from

one cell to another cell, as well as delete cell notes.

The Find feature lets you search for a character string of up to 35 characters in your cell note files. If the string is found, the note in which it appears is brought to the screen and you can decide whether you want to search other notes for the same string.

You can rename a file by selecting the File command from the Options menu. If you choose to rename a *Cell Noter*.CNP file, you must remember to rename the corresponding worksheet. The program will not remind you, and if you forget, your notes will become detached from the worksheet.

PRINT OPTIONS If you want to print your cell notes, *Cell Noter* offers you a full range of options. You can print all the notes attached to a worksheet or select a few, or you can print both the cell note and the contents of the cell to which the note is attached. Before you print cell notes, you can sort them by cell column, cell row, the date the cell was created, or the value in the cell. I found this handy feature to be unique among all annotation programs.

You can also write your notes to a file, as well as to the printer.

Cell Noter isn't as tightly integrated with the 1-2-3, Release 2.x, program as the other 1-2-3 cell annotation programs, but it does work with Release 1A. If you want a basic worksheet annotation program for 1-2-3, *Symphony*, or *The Spreadsheet Auditor*, *Cell Noter* is about \$30 less than the price of any of the other annotation programs.—Catherine D. Miller

MemoryMate

MemoryMate, from Broderbund Software, is designed to organize all of your small bits of random information, from phone messages to theme ideas for your next presentation. The memory-resident program, which lists for \$69.95, allows you to jot down a note without leaving your current application. More important, *MemoryMate* provides efficient search functions so you can get back your pearls of wisdom as quickly as you store them away. And there is no need to remember specific keywords to find a specific note.

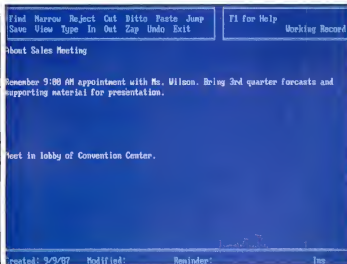
Previously published under the name *Instant Recall* by a software company called Precept, *MemoryMate*, with its basic editing features and search functions, combines the attributes of a word processor and a free-form database.

When you hotkey into the program, you are confronted with a command menu across the top of your screen, and a blank area for text below the menu. You can then simply start typing, as if you are using a simple word processor. When you've finished entering your note, you save it either by choosing the Save option from the menu or by tapping Ctrl-S.

MemoryMate saves the note and presents you with a blank screen so that you can start a new note. Or you can simply pop back into your foreground application.

FINDING INFORMATION To perform a search for a specific note, you enter *MemoryMate*, select Find from the menu, and keystroke a word or phrase that appears in the note. *MemoryMate* isolates all of the notes that have the searched-for word and presents the first of them. You can browse through the other matching notes by pressing the Plus or Minus keys.

■ TSR NOTE-TAKERS



MemoryMate records can consist of whatever text you want to enter. The record can be recalled later by searching for any character string that appears in the record.

tions. That's really useful for doing small tasks that normally would require you to boot your word processor. An AUTO-EXEC.BAT file, for instance, can be pulled into a MemoryMate note, edited, and exported back to the foreground.

MemoryMate accepts notes or records of up to 60 lines of 80-character text. The total database of stored notes can be up to 2 megabytes in size, and within that space constraint, there is no limit on the number of notes stored. MemoryMate may be run as a nonresident application if desired.

—Jonathan Matzkin

Note-It Plus

Note-It, the first memory-resident annotation program, was created specifically for 1-2-3 and was introduced in July 1985. (See the review of Note-It, Version 2, in "Beyond Number Crunching," PC Magazine, Volume 6 Number 13.) The most recent version of the program from Turner Hall Publishing, Note-It Plus, lists at \$79.95 and makes use of the Lotus Add-in Manager, so it works only with 1-2-3, Release 2.x. All notes created with Note-It are upwardly compatible with Note-It Plus.

ATTACH AND ANNOTATE The first step in using Note-It Plus is to attach it to 1-2-3 using the Add-in Manager. Once Note-It Plus is attached, you are ready to annotate your worksheet. You can attach notes to worksheet filenames as well as to worksheet cells.

To annotate a filename, you display the list of worksheet files by using the 1-2-3 /FR command. Then you move your cursor to the filename you want to annotate and press Ctrl-F6 to display a blank note form. To start the editor, press F2. Once you have created the file note, press F6 to save it. The file will be given the same name as the 1-2-3 file, with a .WNT extension appended.

There are two ways to invoke Note-It Plus once your cursor is on the cell you want to annotate. If you want to access the main menu so that you can perform functions other than creating or editing a note, use the Alt-key combination you selected previously when you attached Note-It Plus. If you want to edit or create a note,

notes, MemoryMate's narrow command allows you to redefine your search criteria so that unwanted notes are eliminated. Searching on the word *the* would probably bring up far too many notes. Invoking the narrow command and adding the word *zoo* to the search would eliminate all notes that have *the* but not *zoo*.

You can also organize groups of notes by embedding a common keyword in all of them. If you place the words *convention plans* in all your notes about an upcoming event, searching on that two-word phrase will pop up all the appropriate notes.

FRIENDLY REMINDER When you store a file, MemoryMate prompts you for a date on which you wish to be reminded of the note. When that day comes, MemoryMate automatically presents you with the note when you hotkey into the program. As you store notes, you actually build a tickler file.

MemoryMate also has powerful cut-and-paste capabilities. You can move blocks among notes and, more important, you can pull in screens from applications or export from MemoryMate to applica-

FACT FILE

MemoryMate
Broderbund
Software Inc.
17 Paul Dr.
San Rafael, CA 94903
(415) 492-3500
List Price: \$69.95
Requires: 256K RAM,
one floppy disk drive; DOS 2.0 or later.

In Short: A simple, intuitive way to store and recall notes, ideas, and other random information. Also has useful cut-and-paste and tickler-file functions. Not copy protected.

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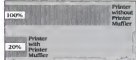
Since the program automatically indexes the entire text of each note, you can search for a note as long as you remember some word or words that appear in it. You can get an individual note by remembering a word unique to it. Or you can narrow down the field by using a word common to several notes, then browsing among them until you come to the one you want.

If a particular search recalls too many

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CIRCLE 272 ON READER SERVICE CARD

■ TSR NOTE-TAKERS

011: (W19) Freight
Enter range for clipboard : B7..D11

	A	B	C	D	E	F	G
	CASH RECEIPTS JOURNAL ENTRY #3						
	DAY	ACCOUNT	DEBIT	CREDIT			
7	15	100 Cash on Hand	\$350.00				
8	15	200 Advertising	\$240.13				
9	15	300 Purchases	\$36.97				
10	15	400 Travel	\$129.43				
11	15	500 Freight	\$25.58				
12	15	620 Sales, Dept. #1		\$74.75			
13	15	640 Sales, Dept. #3		\$267.85			
14	15	700 Sales Tax		\$28.26			
15			\$798.83	\$378.86			

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Using Note-It Plus's Clipboard command, you can choose text from your worksheet to copy to the clipboard and then paste it into a cell note.

■ Note-It Plus can attach 250 notes to a worksheet, and each cell note can contain 500 characters.

use the Shift key in conjunction with the function key that was paired with the Alt key. For example, if you chose Alt-F8 as the activation key, then the Shift-F8 key will pop up the cell note.

Each note form has a status line at the top of the note that includes the cell address, the date the cell information was entered, a portion of the cell entry, and an insert mode indicator. The command-keys line at the bottom of the note form tells you which command keys are active. You can toggle note visibility on and off with the F4 key, making it easy to see your worksheet at any time.

Note-It-Plus can attach as many as 250 cell notes to a worksheet, and each cell

note can contain 500 characters. Since you can link together all cell notes attached to a worksheet, you can effectively have one cell note that contains 125,000 characters. But that might not be an effective way of annotating a worksheet—cell notes could end up being attached to cells to which they have little relevance, just so you can link the information they contain.

Because Note-It Plus uses range names to specify the location of a note in the worksheet, 1-2-3 will automatically update the location of the cell you move in your worksheet, and the notes you attach will be moved with the cells.

FULL FEATURED Note-It Plus has many impressive features. When you use the Browse feature, you use the cursor keys and tab keys to jump from note to note. At the bottom of each note you'll find the last edit date and the total number of notes attached to the worksheet. You'll also see whether the note is linked to another note.

If you want to attach a note to a label or formula in the worksheet you're working on, but need to find the cell location first, the GoTo command will move your cursor



FACT FILE



Note-It Plus
Turner Hall Publishing
10201 Torre Ave.
Cupertino, CA 95014
(800) 556-1234
(800) 441-2345 (in Calif.)
List Price \$79.95

Requires: 512K RAM (uses approx. 70K RAM in addition to RAM required by 1-2-3 and any other resident application); 1-2-3, Release 2.0 or 2.01; two disk drives; DOS 2.0 or later.

In Short: Note-It Plus now uses the Lotus Add-in Manager to integrate more tightly with 1-2-3, Release 2.x, than its predecessor, Note-It. You can annotate spreadsheet file names as well as individual cells. A Browse feature lets you jump from note to note, and the GoTo command puts your cursor in position to document a label or formula anywhere in your spreadsheet. Not copy protected.

CIRCLE 605 ON READER SERVICE CARD

to the spot. You can also search for character strings of up to 40 characters in cell notes or in the cells themselves. In addition, you can move or copy cell notes to other locations in your worksheet.

The Clipboard feature allows you to copy information between any range of worksheet cells and cell notes. A range is specified in the same way as in 1-2-3. When you put text or formula information on the clipboard, you can use the program's WordStar-style editing functions to revise it before you move it off the clipboard.

Note-It Plus has a number of output options. You can print all the notes attached to a worksheet, a single cell note, a list of cells with notes attached, or the cell note and a portion of the cell to which it is attached. And you have the additional choice of directing your output to a file instead of to the printer.

Note-It Plus is a powerful program for documenting a 1-2-3, Release 2.x, worksheet. It is well designed, though not as well integrated with 1-2-3 as is *Noteworthy*. An excellent tutorial included in the comprehensive manual will get you up and running in no time.

—Catherine D. Miller



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Noteworthy

Funk Software's *Noteworthy* lets you pop up notes in 1-2-3, Release 2.x, and *Symphony*. Although you use the Lotus Add-in Manager to attach it to 1-2-3, you can also attach *Noteworthy* to *Symphony*, and the installation instructions in the *Noteworthy* manual are easy to follow.

Unlike the other annotation programs, *Noteworthy*, which lists for \$79.95, doesn't allow you to attach notes to filenames—you can attach notes to the cells of your worksheet only. Nevertheless, I found the program operation to be intuitive, and the features *Noteworthy* offers to create cell notes are, for the most part, superior to those of its competition.

LIMITLESS NOTES Once you position your cursor on the cell you want to annotate, press the activation key you chose when you attached *Noteworthy* to 1-2-3 or to *Symphony*. A blank note pops up, ready for editing. Some of *Noteworthy*'s available keystroke commands are listed on the line above the 1-2-3 worksheet border. There is no limit to the number of notes you can attach to a single worksheet.

You don't have to go through menus to keep track of your notes. To get a listing of

E16: (C2) #SUN(E7..E14)
Select the note window area
Use pointer keys to change window size; set Scroll Lock to move entire window

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

CASH RECEIPTS
JOU

This column shows the total debits recorded on Day #15 - November 15, 1987.

DAY	#	ACC		
15	108	Cash		\$16.00
15	208	Advertising	\$248.13	
15	308	Purchases	\$36.97	
15	408	Travel	\$129.43	
15	508	Freight	\$25.58	
15	628	Sales, Dept. #1		\$74.75
15	648	Sales, Dept. #3		\$267.85
15	708	Sales Tax		\$28.26
			\$798.83	\$378.86

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You can move the *Noteworthy* text window for a note anywhere on your screen. The cell to which the note is attached is highlighted.

cells that have notes attached, along with the cell contents, press F5. To highlight the worksheet cells with notes attached, press F6; if you want to edit a cell note, move your cursor to any highlighted cell, press Return, and your cursor is in position to edit the cell note. In addition, a note indicator appears on the bottom of your screen each time you place your cursor on a cell that has a note attached. So if you're just looking at a worksheet and not necessarily looking for notes, you will be alerted when you move to a cell that is annotated.

Cell notes can be just about any size. You can change the size of the note window, and you can have more text in a note than you can see through the cell window. If you don't want to crowd your worksheet with notes and want to see only a few lines of any note, size your window accordingly and then scroll through the text of the note. This makes a lot more sense than stringing together many notes to attach lengthy documentation to a cell. An added benefit is that smaller notes take up much less disk space, unlike *Note-It Plus* or *Cell Note*.

There are several operations you can perform on a cell note or on groups of notes. You can move a note to another cell

or copy a note to another cell or to a range of cells. You can erase individual cell notes or delete a group of notes at one time. *Noteworthy*'s print support is competitive. You can print one note or all the notes in the worksheet, or you can print a list of them, which includes a portion of the cell's contents. You also have the choice of writing your notes to a file or sending them to the printer.

One feature not found in the other annotation programs reviewed here is the ability to import a text file into a cell note. The entire contents of the file are inserted in the note you select as the destination. Because cell notes can contain as many as 8,000 characters, you can import sizable text files. And once you have imported the file into the note, you can use *Noteworthy*'s powerful editing capabilities to customize the note for the cell you are documenting.

EXCELLENT EDITING You can move your note around by word, line, or paragraph, and you can choose to enter your text in overwrite or insert mode. *Noteworthy*'s block commands let you copy, move, or erase a block of text within your note.

EDITOR'S CHOICE

FACT FILE

Noteworthy,
Version 1.0
Funk Software
222 Third St.
Cambridge, MA 02142
(800) 822-3865
(617) 497-6139
List Price: \$79.95

Requires: 512K RAM (approximately 70K RAM in addition to memory required by 1-2-3 or *Symphony*); 1-2-3, Release 2.0 or 2.01, or *Symphony*; two disk drives; DOS 2.0 or later.

In Short: A powerful and elegant cell annotation program for 1-2-3, Release 2.x, and *Symphony* that makes use of the Lotus Add-in Manager and integrates well with 1-2-3. Offers powerful editing capabilities, importing of text files into cell notes, and great flexibility in size and presentation of cell notes. Not copy protected.

CIRCLE 604 ON READER SERVICE CARD

With *Noteworthy* you can replace a character string as well as search for one. If you choose to search one note only, you must first position your cursor at the point at which you want the search to begin. Then you can replace all occurrences of the character string or any number of remaining occurrences. Or you can choose to search all the notes attached to the worksheet and then replace character strings as you wish.

Noteworthy also lets you copy data between a note and the worksheet. You can copy cell data to a note as the cell formula or as the cell text displayed in your worksheet. If you want simply to insert a cell reference in your note, you have the choice of inserting the cell contents as a formula or as a value.

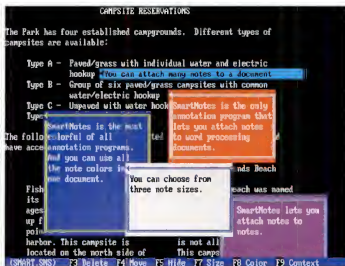
Noteworthy is an elegantly designed cell annotation program, and it offers some features that just aren't offered by its competition.—Catherine D. Miller

SmartNotes

SmartNotes, Version 2, a \$79.95 program from Personics Corp., pops up windows to annotate any information that appears on your screen. With the exception of programs that are graphics oriented (*Microsoft Windows*, for example) or that process keyboard input in an unruly manner (*XyWrite*, for example), *SmartNotes* can be used with just about any program including other memory-resident programs, such as *SideKick* or *ProKey*.

ELECTRONIC GLUE The ability to attach notes to documents created in programs other than *1-2-3* or *Symphony* is unique. *SmartNotes* uses what is called electronic glue to attach notes to any on-screen information. The secret of this method is pattern matching—the context of the note is included in the note file, and when the program finds the context on-screen, the note corresponding to it pops up.

The note's context is highlighted when you pop up a *SmartNotes* note window. The context defaults to the 25 characters preceding your cursor, but you can change it to any number of characters between 5 and 25. Notes attached to DOS files automatically use the filename and extension of the file as the context.



SmartNotes, attached to a WordPerfect document here, lets you attach notes in five colors and three sizes to any document.

If you change the string of characters that make up the context of a note, the note will become detached from the document. But it is a simple matter to reattach it.

When you first invoke the program, *SmartNotes* asks you to name the file that will be used to store your notes. You can choose to use the default filename, specify a new filename, or request to use a *SmartNotes* note file created previously. Whenever you create a note during a computer session, you can choose to use the *SmartNotes* note file you specified initially, request to use a different note file, or create a new one. This allows you to put the notes you create during any one session in any number of note files.

SmartNotes does not have a search feature, but if you are not sure where you have stored a particular note, the Display Notes feature allows you to display the notes stored in any note file. And you can print the notes as well.

Flexibility is *SmartNotes'* strong suit. For instance, there are two ways you can access the program. You can use the activation key to pop up the main menu or use the Make-A-Note key to pop up a note window at your cursor. And you can rede-


EDITOR'S CHOICE

FACT FILE



SmartNotes, Version 2
 Personics Corp.
 2352 Main St., Bldg. 2
 Concord, MA 01742
 (800) 445-3311
 (800) 447-1196 (in Mass.)
List Price \$79.95

Requires: 85K RAM (256K RAM recommended); two disk drives; DOS 2.0 or later.
In Short: A RAM-resident annotation program that allows you to attach notes to just about any application—word processing and database text, spreadsheets, and DOS directory entries. The latest version has added flexibility—you can choose hot keys and un-install the program without exiting, and you have more note display options. Not copy protected.

CIRCLE 603 ON READER SERVICE CARD

fine either hotkey as any two-key combination.

Since *SmartNotes* supports color, you can choose between five colors to color-code your notes; or if you have monochrome graphics, you can choose between

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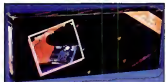
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■ TSR NOTE-TAKERS

five note styles. You also have the choice of automatically including the date in your notes.

You can attach as many notes as you wish to the document on the screen. You can stack notes and attach them to other notes. But you can still see the notes you want to see—or no notes at all when you set the default. You can move a note around on the screen without changing its context and change the size of a note to one, five, or ten lines. You can hide notes you don't want to see.

■ SmartNotes uses what is called electronic glue to attach notes to any on-screen information.

When you call to the screen a document that has notes attached, you can choose to pop up the entire note, markers where a note is attached, or the highlighted context of each note. You can also have the notes pop up only in response to the Activation key. You don't have to see notes when you don't want to.

MAPPING YOUR NOTES The most recent version of *SmartNotes* uses a small 1-2-3 worksheet called the MAP to integrate more completely with 1-2-3. *SmartNotes* uses the MAP to find which cells have notes attached. Before you attach notes to cells, you must first copy the MAP to the worksheet using the SNU utility included with *SmartNotes*. Any time you add or edit notes, you must save the worksheet. If you destroy the MAP or forget to save the worksheet, your notes are not lost—the SNU utility will automatically recover your notes for you.

SmartNotes is a nicely designed and versatile program. Although it doesn't offer the wealth of features found in programs meant to annotate 1-2-3, Release 2.x, worksheets, it does allow you to attach notes to almost any spreadsheet, database, or word processing document.—Catherine D. Miller

Tornado

Like Broderbund's *MemoryMate*, Micro Logic Corp.'s *Tornado* combines word processing and database search functions to organize your random information, but at \$99.95 it lists for \$30 more. *Tornado* creates a record for and indexes the contents of each note.

ELECTRONIC PAPER When you hot-key into *Tornado*, you tap N to create a new note. A small window is opened on your screen to function like a blank piece of electronic paper. You type whatever you like in the window and edit it using a subset of *WordStar*'s command set. The window can be sized, using the arrow keys, and can be enlarged to encompass the entire screen if you like.


A crucial difference between *MemoryMate* and *Tornado* is that *MemoryMate* presents one note at a time, much as a conventional database does, while *Tornado* presents numerous notes at once. They occupy variably sized windows that may overlap on-screen. The current note is identified by its color.

You cycle through the notes on-screen, defining the current note, by tapping the



**EDITOR'S
CHOICE**

FACT FILE



Tornado
Micro Logic Corp.
P.O. Box 174
Hackensack, NJ 07602
(800) 342-5930
(201) 342-6518
List Price: *Tornado*,
\$99.95. Library edition,
\$149.95.
Requires: 128K RAM; one floppy disk
drive; DOS 2.0 or later.
In Short: An unusually well designed, use-
ful package that will help you stay organized.
The multiple-window interface makes using
Tornado intuitive and simple. Not copy
protected.
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Up and Down Arrow keys. If a screen full of notes looks too cluttered, you can tap a number between 1 and 9 to limit the display to that number of notes. Hitting 2, for instance, cuts the display down to the current note and the one directly beneath it.

The advantage of this multiwindow approach is simple. You may be able to find the note you are looking for immediately, by inspection. If you see what you want,

Bids on contract
received after
Jan. 1 will not be
considered.

CONVENTION PLANS
We will be staying
at the Inn. Meals
are included,
except for
Tuesday, when the
entire staff will
attend the banquet
at the restaurant.

Do List

- 1) Revise budget model in time for staff meeting.
- 2) Cash check.
- 3) Speak to Mr. Smith about office equipment.
- 4) Pick up gift for Tommy's birthday.
- 5) Catch up on correspondence.

- 1) Pack passports.
- 2) Check itinerary with travel agent.
- 3) Exchange money for appropriate local currencies.
- 4) Contact neighbors about feeding the cat.
- 5) Buy travelers checks.

Wear a brown suit
to the party, with
matching shoes,
and bring business
cards.

DOS class has been
moved to Wednesday
from Tuesday
night.

Bring copy of
manual and floppy
disk.

Directions to the
theatre:
Go down 4th Street
two lights, make
left, Park at
Joe's parking lot.

WITH MENU, NOTE FILE, DO, INV, TP, TPA, P-E-DB, T2, HSD, SURE, JF955

Tornado's innovative interface presents many notes simultaneously. You can often locate and move to a note by inspection, without using the program's search function.

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■ New Concept

Tornado is a superfast new way to deal with an important type of information. Tornado will not only let you be more productive, it will help you make the decisions you need to reach your goals. Did you ever realize that over half the information you deal with is the **RANDOM** type? Not databases—not spreadsheets—not long documents—but the type scattered around your workplace and in your head. Yet amazingly, until now there was no great software to help you—the tools were either too structured or without organization. But now, at last, there is a quick and easy solution—**Tornado**—acclaimed by review and accepted by corporations nationwide. Whether

you are a business executive, consultant, engineer, or in any other profession, you need **Tornado**—it will save you endless time and effort every day—guaranteed—or your money back. Here is how it works:

■ Information Windows

With **Tornado**, you process information in stacks of superfast "intelligent" windows—several on your screen at once. You type into the windows, interconnect and prioritize them; and scan through them in remarkable ways.

■ Free Form

Tornado is **FREE-FORM**. It works the way you think. To start a new window you just press N, and enter information. No file names.

No extra keystrokes. To retrieve information you just press G (for Get), with any word or phrase—you'll watch **Tornado** zip through your windows like lightning linking and opening those requested. You can even flip through your windows with the arrow keys and watch them instantly pile up and lift away. These are just three of 18 easy but powerful features.

■ Space Station

Tornado is being used on the complex US Space Station project—but it does simple things too: When Harry calls you on the phone, in two seconds flat you'll display the six windows on Harry before he finishes his first sentence! No more embarrassing pauses or scrambling for information. **Tornado** is so versatile you can: write and print a letter faster than ever; track things to do; edit electronic mail; plan a project or event—quickly and easily. You can even build a sophisticated

"knowledge" base—or an unstructured data base—without programming. And that's not all. Track phone conversations, numbers, sales leads, and all your other **RANDOM** information. With the new option you get a "Library" of windows containing: free-form calendar, project planner, grid maker, city/state/area code/time zone translator, and much more. On a portable, **Tornado** is your ideal moving office. Best of all, you tailor **Tornado** to your own needs—easily!

■ 25,000 Windows

Instead of one window or ten, imagine up to 25,000! It's like extra memory...for your brain! The uses are endless. If you can "type" it—you can "Tornado" it. And because it's memory resident (if you choose) you can quickly jump in from other programs—even move information between them. All this power, yet reviewers agree you

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InfoWorld, Review Board

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"simple ... superfast"
New York Times, Diment

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■ TSR NOTE-TAKERS

just tap the arrow keys until that note becomes the current note. Then you can choose to read, edit, or discard. If the sought-after note is not conveniently found through browsing, you can press G for Get to invoke *Tornado's* search function.

To search, you type any word or phrase in the note you seek. A status display tells you how many notes in the pile contain the characters you have typed. As you narrow down the number of notes, you may elect to pop up all of the matching notes at any time by simply pressing Enter. Then you can browse to the desired note within that group by using the arrow keys. If you type in a word or phrase unique enough to isolate a single note, *Tornado* automatically pops up that note for you.

SWAPPING RAM NOTES The pile of notes is maintained by *Tornado* in RAM. You can maintain several different piles and switch between them by storing one to disk and loading another. One pile might be for immediate or important notes, while another could be a place to store older, less-pressing information.

Tornado has cut-and-paste capability, but it falls somewhat short of *MemoryMate* in this department. While *MemoryMate* allows you to paste a specific portion of a note into a foreground application, *Tornado* exports only entire notes. You can get around this limitation by copying the desired text to a new note and then exporting it, but that is somewhat clumsy.

Tornado has some unique features of its own, however. A simple forms generator is useful for phone messages and similar applications. This lets you make such things as an electronic message pad by setting up fields that you can tab through, such as Name, Time of Call, and Message. You define the fields and *Tornado* stores the form for later recall. Then you can use this master form like a simple database record, jumping from field to field with the Tab key. *Tornado* stores filled-out forms without affecting the master copy of the template.

A Library version of the program comes with several prewritten note piles that contain useful information and templates for storing information. A pile called Facts, for instance, has notes with useful information such as ASCII tables

PC EDITOR'S CHOICE

- Noteworthy
- SmartNotes
- Tornado

MemoryMate and *Tornado* are excellent note-taking programs that will organize random information. Their features are almost identical, but *Tornado* gets our nod. Because its multidwindow approach displays many notes at a glance, the user can easily browse without initiating a formal search. *Tornado's* \$99.95 price tag boosts *MemoryMate's* appeal, however.

Among the spreadsheet cell-annotation programs, *Personics Corp.'s* SmartNotes is the only program in this group that lets you attach notes to any application. But if you want to document only 1-2-3 or Symphony spreadsheets, you will want to choose an annotation program that uses the Lotus Add-in Manager to integrate more completely with 1-2-3. Funk Software's Noteworthy is the most powerful and flexible. It's easy to work with and makes intelligent use of your screen by allowing you infinite control over note placement and size. Your choice here is clearly a matter of need instead of price. Both programs sell for \$79.95.

and metric conversions. The Year pile has calendar templates for keeping track of daily events through 1999. While these extras are helpful, most could be generated by users from reference works, and it's hard to justify the extra \$50 they add to the cost of the program.

Tornado is simple to use, easy to learn, and very effective. Its unusual interface, search capabilities, and flexibility make it a very powerful productivity tool indeed.—Jonathan Matzkin

Jonathan Matzkin and Catherine D. Miller are staff editors of PC Magazine.

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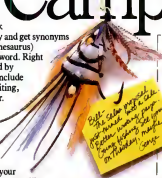
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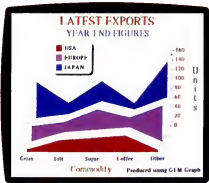
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EGA PLUS CARDS:

VGA RES FOR EGA MONITORS

IBM's introduction of the PS/2 system has thrown the PC market into turmoil on several fronts. Compatible makers worry about the appeal of the new line and how they will coexist with it. Drive manufacturers must redesign for the new system's innovative cable-free construction. Multifunction board vendors need to adapt to the new Micro Channel bus.

The video adapter category is similarly affected by IBM's announcement of a 640 by 480 (horizontal pixels by vertical lines) VGA standard using analog rather than TTL (transistor-to-transistor logic) monitors. Will the new IBM video adapters make obsolete all that has gone before? IBM sells the VGA board in original bus (PC/XT/AT) configuration for \$595, and several third parties plan to clone the board by early next year.



They lack the abundant palette that IBM's new Video Graphics Array standard offers, but EGA Plus cards can give you EGA resolution (640 by 480)—and they deliver it now. You don't have to wait for software that supports the VGA standard.

Since 1984, IBM's 640 by 350 EGA has become the de facto video standard for color graphics in the PC community. A slew of new boards are available that extend the EGA standard to new heights of graphics and text resolution—resolutions of 640 by 480 and beyond. These are known as EGA Plus cards—plus for the better resolution they provide. In this review we look at the ATI EGA Wonder, Genoa SuperEGA, Genoa SuperEGA HiRes, NSI Smart EGA Plus, Paradise AutoSwitch EGA 480, PCG Photon MEGA, QDP VIVA 640/Msync, Quad-EGA ProSync, Sigma Designs EGA 480, STB Systems EGA Multi Res, Tatung Ornicard, Tecmar EGA Master 480 and 800, Thomson EGA Ultra Version, Tseng Labs Eva/480, and Video-7 VEGA Deluxe.

If you don't consider the 8514 adapter's

■ EGA PLUS CARDS

high-resolution options that are intended primarily for CAD, the basic 640 by 480 VGA resolution doesn't seem to offer much that's more worthwhile than EGA Plus boards. All the EGA Plus boards tested here offer this resolution, and several go well beyond it. There's also no difference in the number of colors that can be displayed at one time, at least at this resolution level.

To help you evaluate whether these boards deserve a place in your system now, let's review the history, the current situation, and what is on the horizon in PC color graphics.

THE CGA STANDARD The original CGA standard, introduced back in the dark ages of 1981, was intended primarily for home and game use rather than for business. The coarse 8 by 8 character text cell and grainy color monitor more or less assured this role, since using a CGA system all day was (and is) a likely prescription for eyestrain and headache. Because resolution was so poor, most users of text applications were forced to use IBM's text-only monochrome monitors. A number of high-end PCs had dual monitors for use with 1-2-3—monochrome for worksheets and CGA for graphs. Although the system can produce a palette of 16 colors, CGA normally offers only two groups of four colors each, and then only in a low-resolution 320 by 200 graphics mode. The "high-resolution" 640 by 200 mode supports only two colors—normally black and white!

Two third-party alternatives emerged to address these limitations. One did rather well, the other much less so. The Hercules monochrome system provides graphics in 720 by 348 resolution on normal IBM TTL monochrome monitors. This reasonable resolution and the low cost of both the Hercules card (and its later imitators) and the monochrome monitors were (and still are) appealing to a wide variety of users. The Hercules specifications have earned standard status. The original Herc card still exists, is still popular, and is now priced at an affordable \$249.

An enhanced version of CGA from Plantronics fared less well. It was first offered on the Plantronics ColorPlus board, whose main enhancement was the ability to display the full 16-color spectrum at



Performance Tests: EGA Plus Cards

There were no losers in this comparison of EGA Plus cards. Generally, performance times for all cards were within fractions of seconds of one another on the Lines, Rectangles, and Scroll tests. In the Fill test the times varied by as much as 35 seconds. The Thomson EGA Ultra Version distinguished itself as the fastest EGA card overall. The STB Systems EGA Multi Res and the PCG Photon MEGA were not tested because a Microsoft Windows driver was not available for the products' resolution.

Performance Times

(Times given in seconds. Tests performed at 640 by 480 EGA resolution except where noted.)

	Lines	Rectangles	Scroll	Fill
Video-7 VEGA Deluxe	1.2	4.5	23.6	91.4
QuadEGA ProSync*	1.3	4.5	23.6	91.4
Tatung Omniscard	1.2	4.4	23.5	90.3
ATI EGA Wonder	1.2	4.4	22.9	89.8
Ysang Labs Eva/480	1.2	4.2	22.3	84.9
QDP VIVA 640 Msync†	1.2	4.3	22.5	84.9
Paradise AutoSwitch EGA 480	1.2	4.2	21.4	83.9
Genoa SuperEGA	1.2	4.3	23.3	83.4
Tecmar EGA Master 800	1.3	4.3	23.0	83.4
Genoa SuperEGA HiRes	1.3	4.3	22.6	83.4
Tecmar EGA Master 480	1.3	4.3	23.3	83.4
Sigma Designs EGA 480	1.2	4.3	23.1	83.4
NSI Smart EGA Plus	1.2	4.2	22.7	80.3
Thomson EGA Ultra Version	1.1	2.8	15.9	56.1

*850 by 480 resolution. †648 by 480 resolution.

maximum CGA-style resolution of 640 by 200. The Plantronics methods were emulated by several third-party video adapter suppliers, and several of the boards tested here still offer Plantronics emulation. Not too many software developers support the Plantronics ColorPlus, though, and the emergence of EGA and more-powerful color standards have probably doomed the Plantronics system.

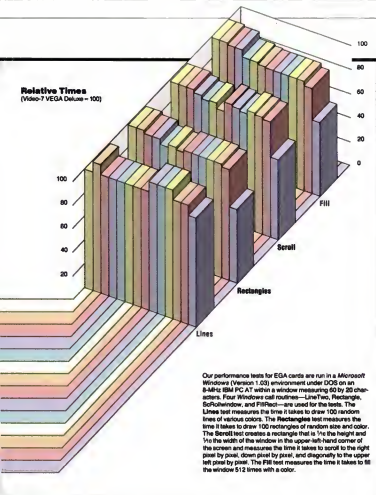
THE EGA STANDARD In 1984 IBM announced two new video cards: the Enhanced Graphics Adapter (EGA) and the Professional Graphics Controller (PGC).

For the first time, color text was read-

able. The EGA's 640 by 350 resolution in 16 simultaneous colors generated impressive graphics, at least in comparison to the CGA. EGA used a text box of 8 by 14 pixels, nearing the 9 by 14 resolution users got from their monochrome monitors and far superior to the 8 by 8 they got from CGA. IBM's own EGA card came with only 64K bytes standard, and an additional 192K bytes of memory was necessary for full performance. The EGA standard uses a higher scanning frequency (16 MHz, as compared with the 14 MHz for CGA compatibles), so a different monitor was required as well.

Another difficulty was limited emula-

Relative Times
(Video-7 VEGA Deluxe = 100)



Our performance tests for EGA cards are run in a Microsoft Windows (Version 1.03) environment under DOS on an 8-MHz IBM PC AT within a window measuring 60 by 20 characters. Four Windows call routines—LineTwo, Rectangle, ScrollWindow, and FillRect—are used for the tests. The Lines test measures the time it takes to draw 100 random lines of various colors. The Rectangles test measures the time it takes to draw 100 rectangles of random size and color. The Scroll test creates a rectangle that is 1/10 the height and 1/10 the width of the window in the upper-left-hand corner of the screen and measures the time it takes to scroll to the right pixel by pixel, down pixel by pixel, and diagonally to the upper left pixel by pixel. The Fill test measures the time it takes to fill the window 512 times with a color.

tion of the CGA standard. Software that accessed the CGA controller chip's internal registers directly often wouldn't work on the EGA, which provided only BIOS-level compatibility that software developers often bypassed for greater display speed or to perform some unusual manipulations.

The PGC is an expensive adapter offering 640 by 480 resolution. This resolution is a popular format for CAD applications, in which the 4:3 aspect ratio provides what is called a square pixel, giving you circular circles and square squares. Several 640 by 480 boards had achieved reasonable popularity in the CAD market, but the PGC

adapter suffers from very slow performance as well as high cost. IBM's PGC sells for about \$3,000; the Professional Graphics Display for about \$1,300.

If the PGC never caught on as a standard, the EGA certainly did. The process was slow, though, and it took a year or more before a large body of EGA-compatible software appeared. Perhaps the major impetus was the development by a company named Chips and Technologies of a four-chip set that offered all the abilities of IBM's own EGA card, as well as Hercules graphics emulation. Even with a full complement of 256K bytes of video RAM, adapters using the Chips and Technologies

parts entered the market at a much lower cost than that of the IBM EGA. Since then, several other manufacturers, including Tseng, Paradise, NSI, and Genoa, have also designed their own proprietary EGA chip sets, and today you can buy 256K-byte EGA boards for street prices that range from \$200 to \$400.

EGA PLUS Two things led to the development of the video adapters reviewed here. NEC introduced the MultiSync monitor, a color monitor that automatically adjusts its horizontal synchronization over a wide range to match the rate of the adapter card driving the monitor. The MultiSync can handle CGA, EGA, and even PGC adapters, in both digital (TTL) and analog modes. In fact, its specifications are far better than even the 640 by 480 that PGC requires; the NEC is rated up to 800 by 560 resolution. Several other vendors have released monitors with multiple-scan-rate capabilities, including Sony, Thomson, Princeton Graphics, Taxan, and others. In some cases, they even outperform the pioneer NEC. The Sony Multiscan, for example, can display up to 900 by 600.

At the same time, adapter designers determined that providing resolutions higher than the standard EGA 640 by 350 wasn't all that difficult. For the most part, changing an on-board crystal and modifying the ROM BIOS to accommodate new video modes was all that was necessary.

The first boards to exploit these events offered the 640 by 480 resolution of IBM's PGC, but with 640 by 350 EGA compatibility. Several now offer 752 by 410, and a few extend the multiscanning-type monitors to their limits with 800 by 600 resolution. A few less-common intermediate resolutions are available, too.

Another advantage of such boards is their improved text capabilities. With more pixels to work with, the basic character cell can be more dense and, therefore, more readable. Character cells contained as many as 9 by 14 pixels, versus EGA's 8 by 14, CGA's 8 by 8, and monochrome's 9 by 14. They can also display either more columns, more rows, or both. Displaying more characters makes each one smaller but can be extremely useful for spreadsheets and some word processing chores.

While there are distinct differences in

■ EGA PLUS CARDS

the various EGA Plus cards, they are, in many ways, cut from similar cloth. All offer the full 256K bytes of video RAM, IBM's mysterious feature connector, and CGA, MDA, and Hercules emulation. All offer 640 by 480 resolution in addition to the normal 640 by 350 modes, in 16 colors, through a multiple-scan-rate digital monitor.

PS/2 VIDEO Just as EGA Plus boards were becoming available from many vendors, IBM introduced three new video standards with the PS/2 line. The MCGA (Multicolor Graphics Array) is used only in the low-end Model 30; the VGA (Video Graphics Array) is built into the motherboard of the Models 50, 60, and 80; and the 8514/A is a high-resolution standard that's available as an add-in board for the same three models. IBM will be marketing a \$595 standalone version of the VGA for owners of non-PS/2 computers as well.

The VGA standard employs 256K bytes of video RAM, the same as most EGA adapters. Several new display modes are available, including the 320 by 200 256-color mode, 640 by 200 in either 2 or 16 colors, 640 by 350 in 16 colors and 640 by 480 in either 2 or 16 colors. The character cell is 9 by 16, which provides highly legible text.

The Model 30 stands apart from the other PS/2 series computers in several respects, including its video capabilities. The Model 30 MCGA video system is based on the low-resolution CGA standard introduced with the original PC years ago. It includes one 640 by 480 graphics mode, but its 64K video RAM limits this mode to only two colors. It does include a new 320 by 200 mode with 256 colors from a palette of 256,000 colors, and text characters are displayed in an 8 by 16 cell. The worst aspect of this standard is the lack of EGA compatibility. Until software developers offer specially modified versions, MCGA users are stuck with CGA resolution.

The highest resolution announced for the PS/2 is the 8514's 1,024 by 768. The basic 8514/A add-in board provides 16 colors. You can also add a memory expansion kit that ups the color choices to 256 colors from the 256,000 color palette in either 640 by 480 or the full 1,024 by 768 modes. The 8514 adapter with the memory

expansion kit costs \$1,820, and IBM's 8514 monitor drives the total video cost to over \$3,100. While this seems like a lot of money, it actually is quite competitive with third party 1,024 by 768, CAD-oriented display systems.

There are several wrinkles to the new standards. All require use of an analog monitor to display the fine shadings of color that can be displayed. There are also differences in the vertical synchronization rates. The 480-line modes use the normal 60-Hz vertical sync rate, but the 350- and 400-line modes operate at 70 Hz. Some multiple-scan-rate monitors can handle this vertical sync rate. NEC says its MultiSync is compatible with VGA. The ability of others to handle VGA is questionable.

■ One advantage of EGA Plus is downward compatibility to the CGA and Hercules standards. Several of the boards provide this in hardware.

WHITHER EGA PLUS? Where does the introduction of the VGA standards leave EGA Plus boards? It depends on your personal needs, how quickly VGA-supported software appears, and the pace of hardware development.

One potential advantage of EGA Plus is downward compatibility to the CGA and Hercules standards. Several of the boards provide this in hardware, allowing programs that bypass the video BIOS to operate correctly. IBM's VGA ignores Hercules graphics modes entirely, and both CGA and EGA emulation is performed in software. How compatible it will be remains to be seen.

On the other hand, the EGA Plus boards require customized drivers for the relatively limited number of software applications supported in 640 by 480 or higher resolution. Most boards will support

Windows, AutoCAD, and 1-2-3. Programs that don't support EGA Plus will fall back to EGA. Just as no special drivers are required for standard 640 by 350 EGA because so many programs provide EGA support directly, it is likely that over time VGA drivers will be incorporated into most software.

The "over-time" phrase is likely to be significant. There is little software available yet that supports VGA. It probably won't take anywhere near as long for VGA support as it did for EGA, but most observers feel it will still take at least a year (some say 2 years) before VGA support is widespread.

On the hardware side, there appears to be a rapid push for the third-party video adapter vendors to support the VGA standard. Several of the boards we tested already offer some VGA compatibility through special drivers that support VGA BIOS calls, but they cannot drive VGA monitors. They can provide 640 by 480 VGA resolution in up to 16 colors on a digital multiple-scan-rate monitor, but they will not support the 256-color, 320 by 200 VGA mode. Since the current hardware doesn't have bidirectional video registers like the VGA, the EGA Plus boards will fail when and if any software starts to make use of this feature.

Video chip designers such as Tseng and Paradise have already announced VGA-compatible chip sets, and Chips and Technologies and others are known to be developing VGA sets too. The first boards incorporating these new chip sets should be available this fall, with many more appearing early next year.

VGA BANDWAGON Product life-cycles in the video adapter arena are shortening to only 3 to 6 months. Competitive pressures are forcing the board manufacturers to jump on the VGA standard quickly, perhaps in the absence of any real need or consumer demand in the marketplace.

At the same time, boards based on the Intel 82786 and Texas Instruments 34010 graphics coprocessors are finally reaching the market. Either of these advanced chips can provide significant performance advantages, albeit at greater cost.

Overall, then, the video adapter category is clearly in a state of flux, driven by a

VIP

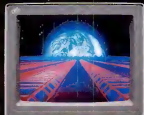
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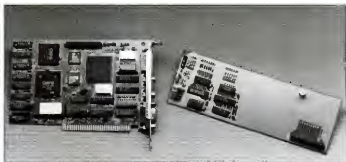
Does this mean you should hold off from purchasing EGA Plus systems reviewed here? Put simply, we don't think so. The EGA Plus boards are solid performers with excellent features that sell for very reasonable prices. They are time-niche products that will provide a lot of value within the next year. It will be a long time before VGA software is commonplace, and even then the new standard doesn't offer much of an improvement over EGA Plus. However, if you are looking into buying a new multiple-scan rate monitor soon, it is crucial that you consider whether it supports analog or digital (TTL) signals (see "Behind the Screens: EGA and Multiscan Monitors," *PC Magazine*, Volume 6 Number 6).

ATI TECHNOLOGIES

ATI EGA Wonder

ATI Technologies' EGA Wonder, which lists for \$399, is getting tremendous attention with its claim to run EGA, CGA, Hercules, and MDA software on any monitor: EGA, NEC MultiSync, standard RGB, 25-KHz color (a special monitor type suitable for a few uncommon video cards), TTL monochrome, and composite. There is a definite allure to EGA high-resolution on inexpensive monitors, especially if you would like to avoid the costs of moving up.

The ATI EGA Wonder performs these miracles with several tricks. On a normal



ATI Technologies claims its EGA Wonder can run EGA, CGA, Hercules, and MDA software on any monitor. A \$99 interface (right) is available for installation in a Compaq portable.

(non-EGA) RGB monitor or a composite monitor, EGA and Hercules software is interlaced to allow the higher resolutions, and the full 64-color palette is retained. ATI doesn't hide the fact that interlacing results in serious flicker, since scanning a 200-line screen twice to simulate a 400-line monitor means that each image is displayed only 30 times a second instead of 60. The company suggests using a long-persistence phosphor or an antiglare or polarized screen filter, claiming that this can reduce the flicker problem 70 to 100 percent.

On a TTL monochrome monitor, EGA and CGA software is converted into shades of gray. The full screen is used, unlike some similar cards that display the image on only a portion of the screen.

The EGA Wonder auto-switches between color and monochrome modes. A utility named SuperSwitch lets you change between software written for color and monochrome standards without changing monitors and without resetting the hardware switches.

While these are impressive capabilities, even with the trade-offs involved, here we are interested in the EGA Wonder's ability to display 640 by 480, 752 by 410 and 800 by 560 resolution on MultiSync-type monitors. With such monitors, the EGA Wonder displays normal CGA software with 8 by 14 characters, and CGA graphics are double-scanned. The newest version of the card also includes support for VGA mode 11 (640 by 480, 2 colors) and VGA mode 12 (640 by 480, 16 colors), but not for the

256-color 320 by 200 mode 13.

The EGA Wonder is a half-length card based on the standard Chips and Technologies four-chip EGA set. It was a plug-in-and-run proposition in our test AT, and ATI's manual was clear and to the point. In addition to a composite output (which most of the boards we tested didn't have), even an RF output is provided. We're hard-pressed to see why someone would buy a card like the EGA Wonder and then connect it to a TV set, though.

ATI offers a special \$99 interface for installing the EGA Wonder in a Compaq portable that attaches to the feature connector on the EGA Wonder. The combination then replaces the Compaq's own video controller.

DIVERSE SOFTWARE ATI supplies a comprehensive selection of applications software drivers, including *GEM* and *Ventura Publisher*, as well as instructions for using the EGA Wonder with *WordStar* and *WordPerfect* in 132-column mode. The 1-2-3 text driver provides 132 by 44, but that's all. This is somewhat less flexible than the various text configurations supplied with some boards.

AutoCAD ADI drivers for 640 by 480, 752 by 410, and 800 by 560 were included with our sample board. This flexibility is welcome, but we had a problem with the highest-resolution version. The NEC MultiSync in our test rig wouldn't lock to the high-resolution image. We had to turn the vertical hold all the way to one end of its rotation, and then adjust the vertical and



FACT FILE

ATI EGA Wonder

ATI Technologies
3761 Victoria Park Ave.
Scarborough, Ontario
Canada M1W 3S2
(416) 756-0711
List Price: \$399

In Short: Tremendous flexibility and low cost. The 800 by 560 mode suffers from excessive flicker, and text performance is slow.

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VGA
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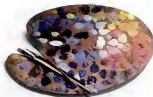
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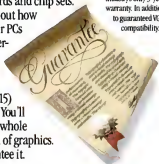
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Brisbane, CA 94005.
(415) 468-6692.

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■ EGA PLUS CARDS

horizontal size and position controls to correctly display the text command area at the bottom of the screen. In addition, we had to fiddle the vertical hold to return to the main text menu when leaving the drawing editor in high resolution. We did not experience any of these difficulties when we tried the EGA Wonder with a Sony Multiscan monitor.

The biggest problem with the 800 by 560 mode is that the ATI Wonder Card reduced the vertical scanning rate to only 49 Hz. This causes serious flicker. A few of the other EGA Plus boards we tested manage 800 by 560 or 800 by 600 without reducing the vertical scan rate. They were able to provide this high resolution without the horrible flicker.

ATI supplies *Microsoft Windows* drivers in 640 by 480, 752 by 410, and 800 by 560 resolution. The installation instructions were misleading, telling us to select an incorrect option to choose the ATI driver while setting up *Windows*. When we ignored the instructions and used some common sense, the drivers worked. As with *AutoCAD*, the flicker in the 800 by 560 resolution was unacceptable. If anything, it was worse in *Windows*. Most users configure *Windows* with dark text on light backgrounds, and the light expanses exaggerate the flickering more vividly than the light on dark normally used in *AutoCAD*. We had no trouble, though, with either the 752 by 410 or 640 by 480 *Windows* drivers. Both looked good.

The EGA Wonder was the slowest board tested on our PC Labs TTY and TTY with Scrolling performance tests. Performance on our many other tests was more or less middle of the road, perhaps a bit toward the slow end of the pack. There have been reports of problems with the board's attempts to do so much with CGA and monochrome monitors, but we didn't test these modes and had no problems with what we *did* test, other than the flicker in 800 by 560 mode.

With the EGA Wonder's \$399 price, you can safely ignore the unusable 800 by 560 flicker show and remind yourself that the board offers 640 by 480 and 752 by 410 resolution for quite a bit less than most of the others you'll find in this review. Also, you get a generous assortment of applications drivers.

GENOA SYSTEMS CORP. Genoa SuperEGA

Genoa Systems Corp., a company that is well known as a manufacturer of PC add-in boards, produced an average board in its SuperEGA.

The Genoa SuperEGA, which lists for \$499, uses Genoa's own proprietary chip set and BIOS. The chips include hardware circuitry to manage CGA, MDA, and Hercules emulations. The card itself is a well-constructed half-length board, with configuration switches accessible through an opening in the backplane. Installation is straightforward.

The SuperEGA's screen mode selection program is attractive and flexible. You can choose from a variety of text layouts, including 80 characters by either 60 or 66 lines and 132 columns by 25, 29, 32, or 44 lines. These modes work with DOS, using the full screen instead of just 25 lines, which was often not the case with the boards we reviewed. Four colorful windows segment the available modes, making it easy to evaluate and choose the avail-

able options. One useful option is double-scanning CGA programs that provide a more seamless and attractive display.

The SuperEGA also lets you bypass normal DOS start-up procedures to boot games. The board resets when you reset your computer (unlike some other boards that maintain their current settings through a boot). However, you can set the mode required by the game (EGA, CGA, MDA, or double-scanned CGA) and directly boot the game floppy disk without resetting the



FACT FILE

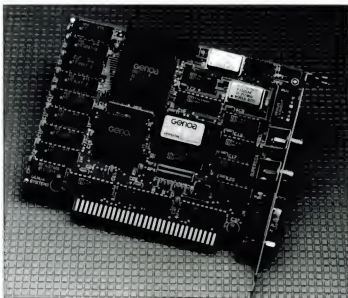
Genoa SuperEGA

Genoa Systems Corp.
73 East Trimble Rd.
San Jose, CA 95131
(408) 432-9090

List Price: \$499

In Short: Unexciting board with middle-of-the-road performance and no price advantages.

CIRCLE 817 ON READER SERVICE CARD



Configuration switches on Genoa's SuperEGA are accessible through an opening in the backplane. The board uses Genoa's own proprietary chip set and BIOS.

system, which accomplishes the same objective.

Drivers for *GEM* and *Ventura Publisher* offer an interesting and attractive 640 by 528 resolution. Along with the familiar *Microsoft Windows*, *AutoCAD*, and *I-2-3* drivers, you also get a *Framework II* driver. The *Windows* driver for 640 by 480 resolution installed as specified and worked fine.

The SuperEGA includes the same nifty *AutoCAD* Creative Logic ADI driver as several other boards tested. It lets you save a view of two-thirds of the screen or so and recall it into a small window that you can position in any of the four corners of the main display area. You can also scroll and pan the image in the small view window. On our performance tests, the SuperEGA performed solidly in the middle.

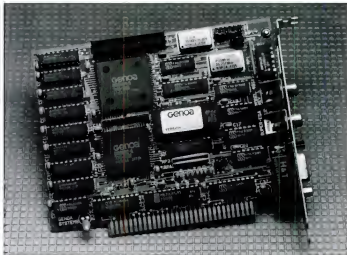
A reputable product from a respected source, the SuperEGA is a little difficult to get excited about. It performs acceptably, but at \$499 it's not particularly a bargain.

GENOA SYSTEMS CORP.

Genoa SuperEGA HiRes

The better multiple-scan-rate monitors are capable of displaying up to 800 by 600 or so. Video adapters that can generate such high resolution and maintain EGA, CGA, MDA, and Hercules compatibility are few and far between, though. One such card is Genoa Systems Corp.'s SuperEGA HiRes.

The Genoa SuperEGA HiRes, which lists for \$599, is distinguished from Genoa Systems' standard SuperEGA by a 39,000/26.824-MHz crystal, in comparison with the standard board's 26.824 MHz. The ROM BIOS is different too.



The Genoa SuperEGA HiRes, which lists for \$599, can achieve a high, 800 by 600 resolution. The board is EGA, CGA, MDA, and Hercules compatible.

These differences probably account for the HiRes's ability to operate at the higher frequencies demanded by the higher-resolution on-screen display.

Otherwise, the two Genoa high-resolution boards are similar.

The manual is also similar. It mentions the 800 by 600 mode a couple of times and gives better explanations for the applications software drivers. Genoa includes drivers for *AutoCAD*; *GEM* at 800 by 600, 640 by 528, or 640 by 580; *Microsoft Windows* at 640 by 480 or 800 by 600; *I-2-3*; *Framework II* at 800 by 600 or 640 by 480; and *Ventura Publisher* at 800 by 600 or 640 by 480. Instructions for patching *WordStar*, Version 4.0, and *WordPerfect*, Version 4.1, are also provided.

The high-resolution 800 by 600 mode performed well on our performance tests. Vertical scanning was not reduced as it was on the ATI-based boards, so there was no increase in flicker. The displays in *Windows* and *AutoCAD* at 800 by 600 were solid on the Sony Multiscan we used for the test.

Two versions of the Creative Logic ADI driver for *AutoCAD* were provided, one for 640 by 480 and the other for 800 by 600. Unfortunately, the view save/restore

and windowing functions don't work at 800 by 600. This isn't an oversight. So many pixels are used at 800 by 600 that there simply isn't sufficient video RAM to do the job (all the boards we tested had the full complement of 256K bytes of video RAM).

The HiRes version comes with the same excellent Genoa setup utility supplied with the standard 640 by 480 board. Three high-resolution text modes, in addition to the 80 by 60 and 80 by 66, are available. A 94 by 29 mode wouldn't work for us, but we found the 100 by 75 and 114 by 60 modes quite legible. All these modes work directly with DOS, with full-screen scrolling. These dense text modes would be especially appropriate with one of the new 16-inch or 19-inch multiple-scan-rate monitors. Our Sony Multiscan handled them well too.

The SuperEGA HiRes was a little slower than the standard SuperEGA, but overall its performance was similar. The \$599 price seems fair compared with the \$695 PCG Photon MEGA (the only other board we tested capable of a full 800 by 600 resolution). If you crave high resolution, the Genoa SuperEGA HiRes is a viable choice.



FACT FILE

Genoa SuperEGA HiRes

Genoa Systems Corp.
73 E. Trimble Rd.
San Jose, CA 95131
(408) 432-9090
List Price: \$599

In Short: Rock-solid, detailed displays at 800 by 600 set this board apart from the pack.

CIRCLE 818 ON READER SERVICE CARD

■ EGA PLUS CARDS

NSI LOGIC INC.

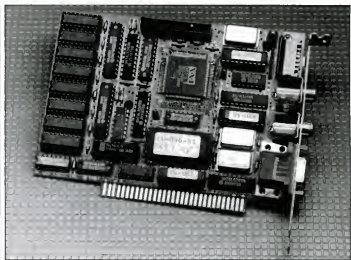
NSI Smart EGA Plus

NSI Logic's entry in the EGA Plus category is called the Smart EGA Plus, a board that lists at \$499. Smart is an acronym for Single Monitor Adapter Technology. Cute, eh? This single monitor business is true enough, as long as your single monitor is an EGA—or a NEC MultiSync if you want access to 640 by 480, 752 by 410, or 800 by 600 modes. In other words, the NSI Smart EGA Plus doesn't attempt to drive anything other than EGA monitors, so it doesn't carry the single monitor claim to anywhere near the same degree as the ATI EGA Wonder or Tatung Omnicaard.

The Smart EGA Plus uses a proprietary chip set designed by NSI Logic. The half-length board is well constructed and solid. Installation was ordinary, a plug in and run. There isn't any single mode or resolution program. Instead, there are several small programs that switch the board to EGA, CGA, MDA, and Hercules modes.

NSI makes a good case for using these manual mode commands instead of what its packaging calls "the headache of auto-switching." The company points out that there are some sophisticated programs that attempt to determine the system's video adapter mode. NSI feels software can confuse auto-switching video boards, with unpredictable results.

The Smart EGA Plus offers a convenient Mode Save feature, which through a warm boot remembers the board's configuration. This is perfect for games that use their own operating systems or otherwise



The NSI Smart EGA Plus, a half-length board, uses a proprietary chip set designed by NSI Logic. Installation is easy—it's a plug-in-and-run procedure.

bypass DOS and require a direct boot from a floppy disk. It's much more straightforward than the cumbersome special disk systems or other methods used by many boards.

EMULATION ABILITY The designers of the Smart EGA Plus included the interesting ability to emulate other EGA-Plus-type cards. NSI claims the card is compatible with the Paradise AutoSwitch EGA 480, Video-7 VEGA Deluxe, QuadEGA ProSync, and PCG Photon MEGA. These boards are supported by a wealth of applications software. If your software includes one of these boards in its repertoire, you can install the software for it and it should work with the NSI Smart EGA Plus as well.

We applaud this idea and wish other manufacturers would move toward a sort of de facto driver standard. On the other hand, the Smart EGA Plus is clearly deficient in the drivers supplied with the board. NSI tells us it is developing its own drivers, but for now you may have to borrow drivers from owners of other boards.

The Smart EGA Plus supports standard EGA 640 by 350 and 640 by 480, 752 by 410, and 800 by 600 modes, but no drivers

are provided for the 800 by 600 mode. Like some other new EGA Plus boards, NSI also claims VGA mode 11 and 12 compatibility.

The Windows drivers NSI provided for 640 by 480 and 752 by 410 worked perfectly, as did standard 640 by 350 EGA resolution. We didn't have a higher-resolution Windows driver from one of the compatible boards.

NSI doesn't provide any driver for AutoCAD. We tried the PCG Photon MEGA high-resolution AutoCAD ADI driver with the Smart EGA Plus to test NSI's claim that its board can use drivers for other boards. It didn't work. Something did happen, because the text display in AutoCAD's drawing editor changed to a finer and smaller font, but the graphics mode never came up. We then tried the AutoCAD 640 by 480 driver supplied with the Paradise AutoSwitch EGA 480, and this worked fine. The Smart EGA Plus also worked perfectly with AutoCAD in the normal 640 by 350 EGA mode.

The Smart EGA Plus performed well in our various performance tests. Though not exceptional, it generally ran on the upper end of the curve.

The NSI Smart EGA Plus is a good per-



FACT FILE

NSI Smart EGA Plus
NSI Logic Inc.
259 B Cedar Hill Rd.
Marlboro, MA 01752
(800) 772-3742
(617) 460-0717
List Price: \$499

In Short: Resolutions up to 800 by 600 and emulation of other EGA Plus cards provide flexibility. Insufficient software driver support.

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LOGITECH

LOGITECH, Inc., 6505 Kaiser Drive
Fremont, CA 94555, Tel: 415-795-8500

■ EGA PLUS CARDS

former, with resolutions up to 800 by 600, at a reasonable price. We would feel a little more enthusiastic if a full complement of software drivers were included, but the emulation of other EGA Plus boards adds flexibility and is a real plus.

PARADISE SYSTEMS INC.

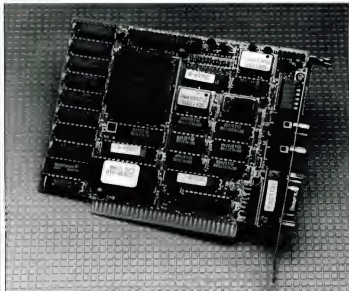
Paradise AutoSwitch EGA 480

Paradise Systems is generally credited with developing auto-switching, an advance in convenient operation of multi-mode video adapter cards. Its newest card, the Paradise AutoSwitch EGA 480, which lists for \$479, adds new features to that flagship.

Basically, the AutoSwitch EGA 480 lets the card automatically adapt its operational mode to the needs of the software. You don't have to issue commands or run a mode-switching program. But the card does not let you run color software on a monochrome monitor. The AutoSwitch EGA 480 includes Paradise's Automatic Monitor Detection (which the company claims is an exclusive feature), which lets you connect the monitor of your choice, again without setting any switches on the monitor.

The AutoSwitch EGA 480 emulates the Plantronics ColorPlus, as well as the CGA, EGA, MDA, and Hercules standard. You don't see very much software supporting the Plantronics standard these days, but the standard does provide more colors in CGA resolution than normal CGA modes.

The AutoSwitch EGA 480 is a well-constructed half-length adapter, with its



The Paradise AutoSwitch EGA 480, a finely constructed half-length adapter, emulates the Plantronics ColorPlus, as well as CGA, EGA, MDA, and Hercules standards.

configuration switches accessible through the backplane. It uses a chip set and BIOS designed by Paradise. The configuration software is convenient and well executed, and it lets you set a mode that allows it to survive a warm boot—perfect for running some game software that must be booted directly.

Paradise's driver support is generous. In addition to the support for *Microsoft Windows, 1-2-3, and AutoCAD* that you'd expect to find, Paradise also includes direct drivers for *GEM, Symphony, CAD-vance, and Ventura Publisher*. The company also gives you instructions for patching *WordStar, Version 3.3, and WordPerfect, Version 4.2*.

Installation is straightforward. We connected it with no problem at all to a NEC MultiSync that was already working with an IBM EGA. Similarly, we had no difficulty with the high-resolution *Windows* or *AutoCAD* drivers. The AutoSwitch EGA 480 provides 132-column text by either 25 or 43 lines in full 8 by 8 characters (which translates to 1,056 and 1,180 dots horizontally in color and monochrome) on stan-

dard EGA and monochrome monitors as well as multisyncs. The text modes were attractive and could be executed on standard monitors.

The AutoSwitch EGA 480 was the fastest board in this review tested in the PC Labs teletype and teletype with scrolling performance tests—and by rather a significant margin. Most of our tests are graphic in orientation, but Paradise correctly points out that many users operate in text mode a great deal of the time. Paradise optimized its BIOS for speed in text functions, and the results of its efforts are clear. On our *Windows* and *AutoCAD* tests, the board's performance was above average.

We didn't test the auto-switching facilities per se, but for several days we switched blithely among a variety of programs and video modes without problem. Auto-switching was a real convenience.

EXCELLENT MANUAL Paradise excels in its documentation. It's beautifully written, understandable, comprehensive, and comes with lovely four-color covers—a class act all the way.



EDITOR'S
CHOICE

FACT FILE

Paradise AutoSwitch EGA 480

Paradise Systems Inc.
217 E. Grand Ave.
South San Francisco, CA 94080
(415) 588-6000
List Price: \$479

In Short: Fast text modes and solid performance across the board. Excellent documentation.

CIRCLE 114 ON READER SERVICE CARD

Case History #47582

"With over a million lines of source code, MortgageFlex is probably the largest application ever written for a LAN," says Lester Dominick, the developer of this monster program for mortgage banking back office management. "We probably encountered just about every programming challenge imaginable, but DataFlex's powerful 4th generation programming language proved more than a match for every situation."

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Data Access Corporation, 14000 S.W. 119 Avenue, Miami, Florida 33186

■ EGA PLUS CARDS

While the AutoSwitch EGA 480 doesn't offer resolution modes beyond 640 by 480, it operates smoothly, without any manual effort, and its \$479 list price is a tad below most of the other boards reviewed. We liked the board and think it's a good deal.

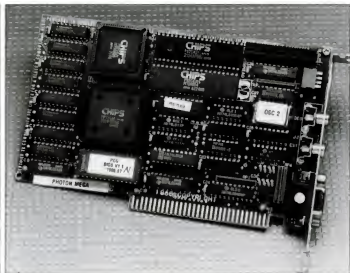
PERSONAL COMPUTER GRAPHICS CORP.

PCG Photon MEGA

The PCG Photon MEGA is a \$695 EGA Plus card aimed at the CAD market, as indicated by its advertising and sales brochures. Personal Computer Graphics Corp. offers an extensive line of CAD-oriented video adapter products. The MEGA is actually the least sophisticated, lowest-resolution, and lowest-cost device.

The MEGA is somewhat longer than most half-length cards. The standard Chips and Technologies four-chip set is used. Installing the MEGA was as easy as most of the other boards tested, although the mediocre manual offers barely adequate explanations and poor illustrations. A four-position switch to set the board's start-up mode is accessible through the backplane.

PCG offers a \$199 option that converts the adapter to drive analog monitors, including the 19-inch large screens often used in CAD applications. This is a small card that attaches to the MEGA's feature connector and includes three small potentiometers to independently adjust red, blue, and green.



The PCG Photon MEGA is somewhat longer than most half-length cards and uses the standard Chips and Technologies four-chip set. The card lists for \$695.

The MEGA was in something of a transition as we reviewed it. PCG had announced partial VGA compatibility (modes 11 and 12) through either a ROM upgrade or software driver, but they were unavailable for testing.

This affected our *Microsoft Windows* performance testing. We didn't receive a 640 by 480 *Windows* driver, since PCG feels the VGA options available in the newest version of *Windows* cover this resolution setting. We did get an 800 by 560 *Windows* driver, which worked as expected. *GEM* drivers were supplied, and *Dr. Halo* drivers became available this fall. Since the MEGA was one of the first available extra-high-resolution EGA-type boards, several CAD programs support the board directly. Instructions were supplied for installing them.

As one might expect from the board's CAD leanings, the MEGA handles *AutoCAD* well. A configuration utility lets you adjust screen characteristics, the number of lines devoted to the text command area, interrupts for networking support, and other parameters. The ADI drivers are very attractive on the screen, and above the command area they display the current layer

name and active color. This is useful, but hardly earthshaking. We achieved good results with 640 by 350, 640 by 480, 800 by 560, and 800 by 600 modes, but we did notice some wavering and an occasional jitter in the display at the two higher resolutions. We didn't note this with the high-resolution *Windows* driver, though.

SAVING VECTORS PCG is readying an interesting feature that should result in improved *AutoCAD* performance. If you have EMS expanded or AT-type extended memory, PCG's Display List Processing will save the drawing's vectors in the extra memory. Redraw times should be reduced dramatically. The Display List Processing wasn't quite ready when we tested the MEGA, but it sounds highly promising.

We had one problem. When we exited *Microsoft Word*, which we used to write this review, the screen went black and the system hung, requiring a warm reboot. We've never had any similar problem with any video boards, including all the others tested here. The problem didn't occur again, though.

The MEGA was the fastest board tested in the PC Labs performance tests. It was



FACT FILE

PCG Photon MEGA
Personal Computer Graphics Corp.
5819 Uplander Way
Culver City, CA 90230
(800) 621-0849 (ext. 418)
(213) 216-0055
List Price: \$695

In Short: Fast, CAD-oriented board also usable for general applications. Good *AutoCAD* driver and upcoming features should improve *AutoCAD* performance still further, but the board is costly.

CIRCLE #18 ON READER SERVICE CARD



Introducing the VGA card that'll knock your socks off.

It's VEGA VGA™ just what you'd expect from the company that brought you the award-winning VEGA Deluxe.

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CIRCLE 336 ON READER SERVICE CARD

■ EGA PLUS CARDS

also faster with *Windows* at 640 by 350 than all but the Thomson EGA Ultra Version.

This performance isn't cheap. At \$695, the MEGA is significantly more expensive than the other boards tested here. While it's faster than most of the other cards, it's neck and neck with the Tseng Labs Eva/480, which costs less and provides hardware pan and zoom. The MEGA *AutoCAD* drivers are outstanding, beaten only by the QDP VIVA's, but it doesn't come with as much software as some others. The Display List Processing features should make *AutoCAD* really sing and dance.

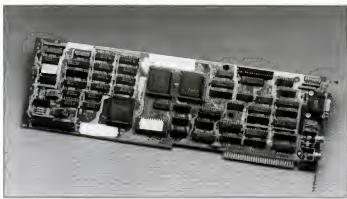
There's no question that the PCG Photon MEGA is a class act, especially for CAD users willing to pay a premium for its unique attributes.

QDP COMPUTER SYSTEMS INC. QDP VIVA 640/Msync

Like Personal Computer Graphics Corp., QDP Computer Systems is best known for its video offerings in the CAD market. Its line includes very high-resolution adapters for use with very big monitors; these products come at a very high cost.

QDP's offering in the EGA Plus market is the VIVA 640/Msync, listing for \$795. As the name implies, QDP's target market is owners of NEC MultiSyncs, Sony Multiscans and the like, since you need such a monitor to take advantage of the board's primary claim to fame—the 640 by 480 mode.

The 640/Msync is basically a Tseng Labs Eva/480, but without the CMII hard-



The QDP VIVA 640/Msync, which lists for \$795, comes with a parallel port but uses a ribbon cable rather than a connector on the backplane.

ware CGA/Hercules compatibility module that's standard with the Tseng. Without the CMII module's special hardware, the 640/Msync performs its CGA, MDA, and Hercules emulations like most EGA boards.

This isn't a severe disadvantage, especially for CAD customers who usually use only the high resolution modes. QDP offers the CMII module as an option for \$100.

The 640/Msync shares many of the other advantages, and a few of the quirks, of its Tseng progenitor. The configuration switches are on the board at the opposite end of the backplane. This means you have to open the computer to make changes. Most users don't change the switch settings once the board is configured, but this is still an unfortunate design decision. Also, the switches are unusually small and hard to read and set.

A parallel port is included, but it uses a ribbon cable rather than a connector on the backplane. This may save money but it means you waste a slot in most situations. As with the Tseng, the port can recognize the presence of a monochrome adapter and switch to LPT2; otherwise it's fixed at LPT1. Incidentally, QDP doesn't include the necessary ribbon cable. It offers it as a \$20 option. The 640/Msync has hardware pan and zoom and uses it in its *AutoCAD* driver but not in other software. There's a little less here, but QDP compensates with

an advanced *AutoCAD* ADI driver.

AutoCAD normally displays a three-line text area at the bottom of the screen. You enter commands here, and the last three lines of text output are visible, too. If you issue any of several commands that need the full screen, the program switches to text mode. When you wish to return to the graphics screen, an often lengthy redraw is necessary. With QDP's driver, a nifty scroll-up window displays text instead of flipping to a text screen. This not only looks neat, it eliminates the need for a redraw.

PAN AND ZOOM The *AutoCAD* driver uses function key sequences to choose between *AutoCAD*'s normal full-screen cross-hair cursor and a small cross cursor, and to invoke hardware zoom. The cursor lets you pan, even when you've zoomed in via hardware.

In addition to the normal 640 by 480 *AutoCAD* driver, a 720 by 512 ADI driver is included. It expands the images horizontally to too great a degree and splits the command menu into two side-by-side sections that are terribly confusing, since you still can move only up and down to reach the commands. On a brighter note, it includes pop-up function key help, pan freeze to disable the hardware pan during hardware zoom and a useful color menu to remind you of *AutoCAD*'s numeric color equivalencies.



FACT FILE

QDP VIVA 640/Msync
QDP Computer Systems Inc.
23632 Mercantile Rd.
Beachwood, OH 44122
(216) 464-6600
List Price: \$795

In Short: Excellent *AutoCAD* driver uses hardware pan and zoom. Performance is good, but price is high for non-CAD applications.

CIRCLE #19 ON READER SERVICE CARD

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■ EGA PLUS CARDS

Both versions of the ADI driver use attractive colors. They pop up the menu bar on the right side of the screen only when you move the cursor to the far right of the display. This gives you a larger displayed image.

These *AutoCAD* drivers are significantly better than the drivers supplied by most vendors. A similar driver for *VersaCAD* was documented but not supplied with our review sample.

QDP also included a 640 by 480 *Windows* driver (but not one for the odd 720 by 512 format available with the CAD drivers) that worked well.

The documentation for the 640/Msync itself was similar to Tseng's but it was poorly printed. There's also an Owner's Manual of equally poor quality. It includes references to many other QDP boards, various monitors that could never be used with this board, and other information sure to confuse many buyers.

Like the Tseng Labs Eva/480, the 640/Msync is a fine performer. The 640/Msync was one of the fastest boards tested on several of our performance tests, and it performed no worse than average on the others.

QDP's \$795 price seems high, considering that the similar Tseng Labs Eva/480 comes with hardware emulation daughter-board, parallel cable, and "hotzoom" software for \$215 less. The 640/Msync's saving grace is the lovely *AutoCAD* driver (and no, it doesn't work with the Tseng). If you're an *AutoCAD* user, you have something to ponder. If you're not, the Tseng is clearly a better value.

QUADRAM CORP.

QuadEGA ProSync

Quadram Corp. is one of the leading manufacturers of PC peripherals, adapter cards, and compatible computers, and it boasts a reputation for innovation and solid support of its products.

The QuadEGA ProSync tested here is actually an OEM version of the popular Video-7 VEGA Deluxe, but with some differences in the software supplied.

Quadram heavily promoted its video boards with combination offers for hardware and software. The ProSync package we reviewed included offers for Quad-



FACT FILE

QuadEGA ProSync

Quadram Corp.
One Quad Way
Norcross GA 30093-2919
(404) 923-6666
(404) 564-5566
List Price: \$495

In Short: Solid performer with good driver support. Special offers for software and hardware can save money.

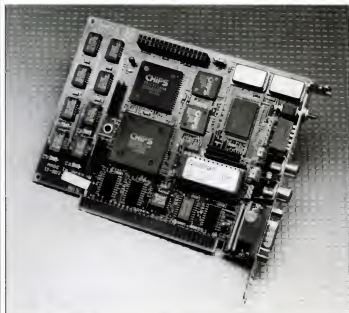
CIRCLE 811 ON READER SERVICE CARD

ram's Q-Mouse optical mouse for \$45 (retail, \$145), a copy of *Microsoft Windows* for \$30 (retail, \$100), a 9-pin to 25-pin adapter for \$8.95, pop-up menu creation software for the mouse for \$19.95, and Digital Research's *GEM* for \$30 (retail, \$249). If you're in the market for these kinds of options, the money you would save would represent a hefty fraction of the cost of the ProSync.

The ProSync is an elegant surface-mount half-length card that includes an accessible configuration switch and monitor toggle switch that make installation and configuration changes a delight. A simple utility program helps you install the drivers and other software. You choose monitor and resolution modes and invoke the screen saver with a simple command line utility. An AutoSelect feature automatically selects the correct display mode for your software.

The ProSync's software assortment is something of a mixed bag compared with its VEGA Deluxe progenitor. Quadram supplies the 120 column by 25- and 43-line Lotus modes, but not the equivalent 132-column NEC MultiSync modes. *GEM* drivers for both 640 by 480 and 752 by 410 were supposed to be provided.

The ProSync package includes the same snazzy *AutoCAD* Viewport ADI driver and the game boot disk provision as supplied by Video-7. However, the VGA-emulation BIOS was not included. In other words, with the exception of the *GEM*



Quadram Corp.'s QuadEGA ProSync, a surface-mount half-length card, is an OEM version of the popular Video-7 VEGA Deluxe card with different software.

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■ EGA PLUS CARDS

driver, Quadram seems a little behind Video-7 in driver support. Quadram was scheduled to ship the additional Lotus modes and the VGA emulation by this month. They also planned to switch to Chips and Technology's newer two-chip set, which provides better Hercules graphics emulation.

Our tests of *Microsoft Windows* in 640 by 350, 640 by 480, and 752 by 410 resolution were untroubled. Ditto for the *AutoCAD* tests at the same resolutions.

The ProSync has the same feel as the VEGA Deluxe. There are no unpleasant surprises. The \$495 list price is somewhat more attractive than the Video-7 VEGA Deluxe's identical price, considering the plethora of discount offers included with the Quadram. Of course, these deals are significant only if you want or need what's being offered. Even if you don't, the QuadEGA ProSync is a fine product.

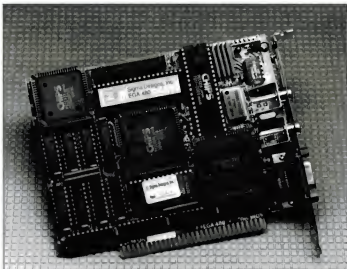
SIGMA DESIGNS INC.

Sigma Designs EGA 480

Sigma Designs' entry in the EGA Plus category is the EGA 480, which lists at \$399. It's a half-length card using the common four-chip Sigma and Technologies EGA set with a Sigma BIOS. We experienced no problems during installation. A five-position switch accessible through the backplane configures the card; there are a few jumpers on the board that you probably won't need to touch.

A simple command-line-type utility lets you choose among the CGA, MDA, and Hercules emulation modes. A full assortment of software drivers is supplied, including *Microsoft Windows*, *GEM*, *AutoCAD*, Lotus's *1-2-3* and *Symphony*, and *Ventura Publisher*. A text mode of 132 by 25 is provided, and it works with DOS without any modifications to DOS itself. However, none of the other useful text modes provided by many competitive boards (80 by 60, 80 by 66, 132 by 44, and so on) are available.

The *Windows* drivers worked well at standard 640 by 350 EGA, 640 by 480, and 752 by 420. Note that that last resolution is 752 by 420, not 752 by 410. Sigma says that it attempted to provide a little more resolution than do the many other boards that offer 752 by 410. Strangely,



The Sigma Designs EGA 480, a half-length card selling for \$399, is configured by a five-position switch accessible through the backplane.

the packaging mentions 752 by 410. We were not able to discern any difference on the screen, so we're not really sure what the exact resolution in this mode is. The difference wouldn't be of great significance anyway.

AutoCAD ADI drivers are provided for both single- and dual-screen configurations, in both 640 by 480 and 752 by 420 resolution. While dual screens aren't really necessary with *AutoCAD*, some users may find the extra graphics display space of the second monitor worth the expense and desk space. The Sigma was the only board we tested that provided dual-screen drivers—an advantage if double monitors appear to you.

Both ADI drivers were plain, standard issue. We much preferred the screen fonts and overall appearance of the 752 by 420 (or 752 by 410) driver, but both did the job.

Sigma includes a complete copy of *PC Paintbrush*, a fine paint program. The software is packed with the board, so you don't have to redeem coupons or go through anything else before you can start using the free software.



FACT FILE

Sigma Designs EGA 480

Sigma Designs Inc.
46501 Landing Parkway
Fremont, CA 94538
(415) 770-0100
List Price: \$399

In Short: Good price and free *PC Paintbrush* software, but performance was unexceptional.

CIRCLE 610 ON READER SERVICE CARD

SOFT-SWITCHING Sigma says the EGA 480 can soft-switch between EGA and CGA, or you can lock this auto-emulation on via one of the switches accessible from the backplane. We were not happy with this. One time it locked up so that our only recourse was the big red switch when we tried to execute a simple directory utility that makes extensive use of color. Investigation revealed that the EGA 480 probably had turned off the hardware emulation, although we hadn't issued any command to do this. With the emulation switch on,

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■ EGA PLUS CARDS

issuing the command to force CGA emulation resulted in the message "Emulation HW ON but SW NOT installed. NMIs may be turned off." Once again the system was locked tighter than a drum.

Sigma tells us that this problem has been fixed. We also reported to it that issuing a slightly incorrect command (SET-EGA CGA:ON, used with many other boards, instead of SETEGA CGA ON) also locked us up. We know we shouldn't issue wrong commands, but the hardware and software shouldn't go off to the twilight zone either. The company also promised to fix this.

The packaging claims that the EGA 480 is "the only graphics board that meets all four PC standards." Well, the manufacturers of the other 15 boards reviewed here will be interested to learn that.

Performance on our performance tests was unexceptional. The EGA 480 was in the middle of the pack.

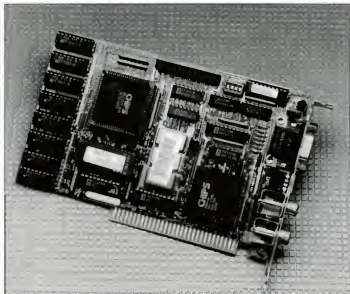
The EGA 480 sells for only \$399, well below most of the boards tested (only the ATI, Tatung, and STB are in the same price bracket). The free copy of *PC Paintbrush* makes it an even better buy. We've had good results with Sigma equipment, and if the company remedies the problems, the board could be a low-cost option.

STB SYSTEMS INC. STB Systems EGA Multi Res

For the most part the similarities among the boards reviewed here far outweigh the distinctions. But STB Systems' EGA Multi Res stands out from the rest.

The board, which lists for \$399, went on the market this summer with no useful software, and that's the way it came to us! No setup utility, no mode-selection software, no applications drivers for *Windows*, *GEM*, *1-2-3*, *AutoCAD*, and the like. Nada!

A demo disk, a simple diagnostic that showed the various modes available, was included with the board, but it left the screen locked in a tiny-character mode, and there was no software to return the display to normal. We had to reboot. A card in the box offers RF drivers for *AutoCAD*, *Microsoft Windows*, *Framework*, *1-2-3*, and *Symphony* FREE OF CHARGE



Software drivers for the \$399 STB Systems EGA Multi Res should be available by now, but the board went on the market this summer without the necessary software for setup and configuration.



FACT FILE

STB Systems EGA Multi Res

STB Systems Inc.
P.O. Box 850957
Richardson, TX 75085-0957
(214) 234-8750
List Price: \$399

In Short: Least-costly board tested. Good hardware was released on the market with insufficient software support.

CIRCLE 606 ON READER SERVICE CARD

(STB's capitalization). Does STB think that buyers wouldn't want the drivers? The response card to order the drivers wasn't even postage paid. Phooey!!

STB told us the drivers simply weren't ready. It said it hoped to transfer drivers from a previous board, but some engineering changes in the Multi Res rendered the earlier drivers inoperative. STB did send us the one driver that was available at this writing, an *AutoCAD* ADI driver, but that

was all that was available even if you sent in the response card.

If STB's predictions were accurate, the drivers should be available by now. Double phooey, nonetheless. STB should never have released the card for sale without appropriate software.

The Multi Res employs an 8 by 14 font that's distinctly different from the EGA standard. It's not particularly unattractive, just different. If you have a multisync monitor, you can also switch to what STB calls a VGA font, with a 9-by-16-character cell.

SMALLER DISPLAY As an added flip, the Multi Res display is noticeably smaller than those of the other boards. You could probably adjust your monitor's size controls to compensate—but it's another oddity on STB's list.

The Multi Res includes two four-position configuration switches, one of which is accessible through an opening in the backplane. The primary switch settings were straightforward enough, but those for

■ The versions of the ADI *AutoCAD* driver we received with the STB EGA Multi Res achieved an unusual 832 by 350 resolution that we really liked.

the second switch were confusing and difficult to read and adjust. The factory settings on the board were not the same as those noted in the manual, but the board worked anyway with our Sony Multiscan monitor.

The manual simply stopped after guiding us through installing the Multi Res, which made sense since there was no software to discuss.

The three versions of the ADI *AutoCAD* driver we received with the Multi Res let you use 640 by 480, 752 by 410, and an unusual 832 by 350 resolution that we really liked, although we hadn't seen it before. These drivers were plain and somewhat slow, but they worked well nevertheless. Numerically, the resolution offers slightly fewer pixels than the other EGA Plus resolutions, but the added horizontal resolution looked quite good on many images we examined.

The board performed well on our performance tests, although it was far from the fastest in this review. Without high-resolution drivers however, we couldn't test *Windows* performance in anything other than standard EGA 640 by 350 mode, in which case the Multi Res performed very nicely.

Testing the Multi Res was frustrating, and we reiterate that STB shouldn't have shipped the board without full software support, but there was a significant counterbalance here: the price. At \$399, the STB EGA Multi Res could be an excellent value when the software drivers become available.

TATUNG CO. OF AMERICA INC. Tatung Omnicaard

Tatung Co. of America, yet another company known for its monitors, is now offering video adapters. Its Omnicaard, formerly marketed as the Supreme EGA, lists for \$399 and is almost a total clone of the ATI EGA Wonder.

A card inserted into the manual explaining the board's new features (including ATI's new VGA partial emulation) is an exact copy of the one that accompanies the ATI EGA Wonder card—definitely not the subtlest example of repackaging we've ever seen.

Our descriptions of the ATI card's design and operation apply to the Tatung Omnicaard video adapter as well. As with the ATI, you supposedly can run EGA, CGA, Hercules, and MDA software on CGA, monochrome, TTL, and composite monitors, and even televisions, via the RF output. The Omnicaard provides gray scaling as well.

We didn't test all these interchange modes, since our objective was to test the Omnicaard as an EGA Plus card. As such, it functioned as expected in all four *Micro-soft Windows* modes (640 by 350 standard

EGA, 640 by 480, 752 by 410, and 800 by 560). Taking the same action as the EGA Wonder, the 800 by 560 driver switches the vertical-scanning rate down to a mere 49 Hz. This unfortunately causes serious flicker.

Tatung sells the Omnicaard for the same \$399 as ATI's EGA Wonder. It has the same benefits and weaknesses, too. While its 800 by 560 mode is more or less unusable, especially with *Windows*, it does well with other drivers. It's not the fastest board around, but it is one of the least expensive.

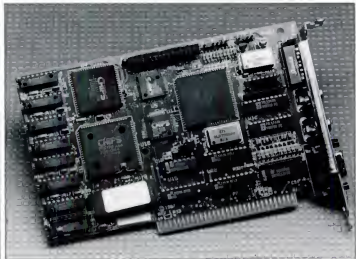


FACT FILE

Tatung Omnicaard
Tatung Co. of America Inc.
2850 El Presidio St.
Long Beach, CA 90810
(800) 421-2929
(213) 979-7055
List Price: \$399

In Short: Flexible and inexpensive. Fine driver support, but unexceptional performance and unacceptable flicker in high-resolution 800 by 560 mode.

CIRCLE 406 ON READER SERVICE CARD



The Tatung Omnicaard, which lists for \$399, was formerly marketed as the Supreme EGA. The half-length card has gray scaling, along with its standard modes.

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- Application Techniques ... NCP
- Pizzazz 2.0 (see what your printer is missing) 45.
- Ashton-Tate ... NCP
- dBase III Plus 1.1 (the standard) call
- Framework II 1.1 call
- MultiMate Advantage II 1.0 299.

ATI ... NCP

- How to use DOS, BASIC each 33.
- How to use Lotus, dBase III Plus each 43.
- Bible Research ... NCP
- THE WORD 4.0 (specify KJV or NIV) 159.

Borland International ... NCP

- Sidekick 1.5 57.
- Turbo BASIC 1.0 67.
- Turbo C 1.0 67.
- Turbo Pascal 4.0 67.
- Superkey 1.1 67.
- Turbo Lightning 1.0 (spellx, thesaurus) ... 67.
- Reflex Workshop 67.
- Reflex 1.1 99.
- Eureka 1.0 109.
- Quattro 1.0 129.
- Paradox 2.0 (easy-to-use database) call

Breakthrough ... NCP

- Timeline 2.0 (project management) 289.
- Broderbund ... CP
- Print Shop (banners, signs, etc.) 35.
- Print Shop Companion (tools for Print Shop) 33.

Computer Associates ... NCP

- SuperCalc 4 1.1 299.
- Core International ... NCP
- Corefast 1.3 109.

Crosstalk Communications ... NCP

- Crosstalk XVI 3.61 95.
- Crosstalk MK 4.0 129.

Dac Software ... NCP

- Dac Easy Base 1.0 32.
- Dac Easy Payroll 2.0 45.
- Dac Easy Accounting 2.0 59.
- Dac Easy Bonus Pak 89.

Daybreak Technologies ... NCP

- Silk 1.0 99.

PC Connection Software Special

through December 31, 1987

ALPHA SOFTWARE CORP. ... NCP

Alpha/Three 1.1

What an idea. An inexpensive, powerful database program that fully supports the DBF file format found in more expensive programs with no conversion needed. If you use the leading database and like to let others use or work your data files, check this out.

- Fully menu driven; uses DBF file format; will read and write files created with dBase II or III without conversion
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- Supports over 50 complex mathematical, string, and logical functions
- Supports free-form data entry; with up to 26 input forms per database

For PC, XT, AT, PCjr; XT286 & PS/2 ... \$219.

Digital Research ... NCP

- Gem Draw 1.0 189.
- Gem Presentation Team 1.0 319.
- Gem Desktop Publisher 1.0 259.

Executive Systems ... NCP

- XTREE 2.0 (DOS shell) 45.
- Hot 4.0 95.

5th Generation ... NCP

- Fastback 5.14 (hard disk backup) 89.
- Fastback Plus 1.0 99.

Funk Software ... NCP

- Sideways 3.2 42.
- Sideways 1.0 49.
- Inword 1.0 59.

Generic Software ... NCP

- Generic CADD 3.0 (full-featured) 69.
- Dot Plot 3.0 35.
- Auto Dimensioning 3.0 35.

Hervad Associates ... NCP

- PC LOGQ 2.0 89.
- Smartcom II 3.0 89.
- Headlands ... NCP
- PC TALK 1.3 55.

Hilgrees Software ... NCP

- HyperAccess 3.2 89.
- Individual Software ... NCP
- The Instructor II 26
- Directory Assistance 1.0 33.
- Professor DOS (with Smartguide) 33
- Smartguide (mem. resident DOS reference) 15.
- Typing Instructor II 26.

Intersecting Concepts ... NCP

- Display Master 2.11 (for EGA systems) ... 39

Javelin Software ... NCP

- Javelin 1.1 (more than a spreadsheet) ... \$69.
- Javelin Plus 2.0 159.

Lifetree ... NCP

- Volkswriter Deluxe Plus 1.0 69.
- Volkswriter 3.1.0 147.

Micro Education (MECA) ... CP

- Managing Your Money 4.0 129.
- MicroPro ... NCP
- WordStar Professional Release 4.0 259.
- WordStar 2000 Plus Release 3 229.

Microrim ... NCP

- R-base System V 1.1 (with Express) 429.
- dB Graphics 1.0 199.

Microsoft ... NCP

- Learning DOS (for any version) 33.
- Windows 2.0 65.
- Works 1.0 119.
- Bookshelf (CD-ROM) 189.
- Project 4.0 319.
- Word 4.0 239.
- Chart 3.0 249.
- Excel 1.0 (req. 80286/80386 CPU) 319.

LANGUAGES

- Quick BASIC 4.0 59.
- Macro Assembler 5.0 97.
- FORTRAN Compiler 4.01 289.
- C Compiler 5.0 279.

Migent ... NCP

- Ability 1.2 65.
- Ability Plus 1.0 149.

Monogram ... NCP

- Dollars & Sense 3.0 105.
- Nantucket Software ... NCP
- Clipper (Autumn '86, dBase Plus compiler) 399.

New England Software ... NCP

- Graph-in-the-Box Release 2 57.

Nolo Press ... NCP

- R/W Writer 1.0 35.

North Edge Software ... NCP

- Timeslips III 3.1 119.

Paperback Software ... NCP

- CVP-Planner 1.37 (1-2-3 vers. 1A compet.) ... 57.
- CVP-Planner Plus 2.0 95.
- CVP-Info 1.4 65.
- CVP-Expert 1.2 (expert system) 65.
- CVP-Graphics 1.0 65.

Paul Mace ... NCP

- H/Text/H/Format 1.5 (hard-disk tools) 49.
- Mace Utilities 4.1 (DOS utilities) 59.
- Parsonica ... NCP
- SmartNotes 2.0 (Post-it-like notes) 49.
- SeeMORE 1.0 49.

Quarterdeck ... NCP

- DESQView 2.0 (operating environment) ... 79.
- Expanded Memory Manager 4.0 39.

Simon & Schuster ... NCP

- Typing Tutor IV 33.
- Webster's New World Writer 1.04 59.

Softlogic Solutions ... NCP

- Software Carousel 2.0 (everything resident) 35.
- Disk Optimizer 2.02 35.
- Liberty 1.0 59.

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Software Publishing ... NCP

PFPS First Publisher 1.0	\$59.
PFPS First Choice 2.0	89.
PFPS Professional Write 1.03	119.
PFPS Professional File 1.01	149.
Harvard Graphics 2.0	239.

Springboard ... NCP

Newsroom+Pro	45.
Symantec ... NCP	
Q & A 2.0 (database, word processor)	209.
Q & A Write 1.0	119.

Traveling Software ... NCP

LAP-LINK 2.0 (5 1/4" to 3 1/2" end back)	79.
True BASIC, Inc. ... NCP	
True BASIC 2.01	57.
True BASIC Libraries	each 32.

Turner Hall ... NCP

SpellInt 1.0	49.
SQL 1.5 (make 1-2-3 sheets smaller)	49.
Note-It Plus 2.0 (notes on 1-2-3 sheets)	49.
Word 1.0 (add word processing to 1-2-3)	59.
Cambridge Spreadsheet Analyst 2.02	59.

Unison World ... NCP

Newsmaster 1.0	57.
WordPerfect Corp. ... NCP	
WordPerfect Executive 1.0	119.
WordPerfect 4.2 (one of the best)	199.

WordTech Systems ... NCP

dBXL 1.1	89.
QuickSilver 1.1	359.
Xerox ... NCP	
Venture Publisher 1.1	489.

EDUCATIONAL

Barron's ... CP

Computer SAT	35.
Blue Lion ... CP (requires CGA or EGA)	
Ticket to London, Paris, or Spain (specify)	25.
RSVP (etiquette & international business protocol)	25.

Stolts & Assoc. ... NCP (reqs. graph. brd.)

My Letters, Numbers, Words (ages 2 to 6)	27.
Kids Stuff (ages 2 to 6)	27.

True BASIC, Inc. ... NCP

Trigonometry	32.
Algebra	32.

RECREATIONAL

Accolade ... CP (reqs. graphics brd.)

Hardball (baseball simulation)	24.
Mean 18 (great golf game, CGA or EGA)	29.
Electronic Arts (reqs. graphics brd.)	
Starlight (NCP)	32.
Chessmaster 2000 (CP CGA or Hercules)	32.
Chuck Yeager's Flight Simulator (CP)	32.
Grand Slam Bridge (CP)	45.

Hayden Software ... CP

Sargon III (chess, reqs. EGA or Hercules)	15.
-------------------------------------------	-----

Infocom ... NCP

Bureaucracy	Stationfall	Lurking Horror
Hollywood Hijinx		Hitchhiker's Guide

PC Connection Hardware Special

through December 31, 1987

KRAFT SYSTEMS ... 1 year

Three-button Joystick

Plus ACCOLADE ... NCP

Hardball

A famous person said a few years back that there's nothing like central heat to bring in a crowd. Since then, everyone up here has it, so we needed a little better draw. After all, what would be better than the Boys of Summer to warm up those Nights of Winter?

- Kraft Premium Joystick will self-center or float free; includes an 8-foot cable; connects to a standard PC game port; and has an extra fire button on top of the stick. \$33.
- Accolade Hardball has full-size, 3D animation, and allows you to play against the computer or a friend (requires graphics board). 24

For PC, XT, AT, XT286 ... both just 49

Leather Goddesses of Photos ... each 25

Zork Trilogy ... 49.

Microleague Sports ... CP

Microleague Baseball (requires CGA) ... 25.

Microprose ... CP

F-15 Strike Eagle (requires CGA) ... 22.

Silent Service (requires CGA) ... 22.

Gunship (requires CGA or EGA) ... 32.

Microsoft ... CP

Flight Simulator 2.13 (reqs. graphics brd.) ... 32.

Mindscape ... CP

Balance of Power (reqs. graphics brd.) ... 30.

Parlor Software ... CP

Bridge Parlor (best Bridge simulation) ... 49.

Sierra On-Line ... CP

Leisure Suit Larry (requires CGA or EGA) ... 25.

Space Quest (requires CGA or EGA) ... 33.

King's Quest III (requires CGA or EGA) ... 33.

Simon & Schuster ... CP

Star Trek/Promethean Prophecy ... 27.

Sphere, Inc. ... NCP

GATO (submarine simulation, requires CGA) ... 12.

Orbiter (shuttle simulation, requires CGA) ... 27.

Sublogic ... CP

Jet (requires graphics board) ... 33.

XOR ... NCP

NFL Challenge ... 69.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

AST Research ... 2 years

IO Mini 2 C/S/P ... \$69

NEW! SixPakPlus 64k C/S/P

(now upgrades to 576k) ... 129.

SixPakPremium 256k C/S/P

(upgrades to 1 Meg or 2 Meg w/Piggyback) call

Advantage Premium 512k S/P

(upgrades to 1 Meg or 2 Meg w/Piggyback) 299

RAMpage! 286 512k (upgrades to 2 Meg) 339

RAMpage! 2 64k (upgrades to 2 Meg) ... 209

Hot Shot 286 ... call

AST Premium series boards and RAMpage!

boards support EMS and fully support EEMS.

Amdek ... 1 year

LaserDrive-1 (CD-ROM Drive) ... 629

Video 310A (amber monochrome monitor) 139.

Video 410A (amber monochrome monitor) 169.

Compuable ... 2 years

2-Position switch box ... 39.

3-Position switch box ... 59.

Cuesta ... 1 year

Datasaver 200 Watt (PC backup power unit) 339

Datasaver 400 Watt (AT backup power unit) 459

Curtis ... lifetime

ACCESSORIES

Disk Holder (holds 50 5 1/4" disks) ... 8.

Printer Stand ... 18.

Universal System Stand ... 25.

CABLES

Smartmodem-to-PC Cable (9 feet) ... 17.

Printer-to-IBM cable (9 feet) ... 17.

SURGE SUPPRESSORS

Safesite (6 outlets) ... 21.

Diamond (8 outlets) ... 32.

Ruby (6 outlets; EMI/RFI filtered; 6 ft cord) ... 59.

Ruby-Plus (w/EMF & modem protection) ... 69.

DCA ... 1 year

Irms 2 (3270 models board) ... 729.

Irms PS/2 (for Models 50 and 60) ... 729.

Epson ... 1 year

All cps speeds listed are for 12 cps mode

EX-800 printer (80 column, 300 cps) ... call

EX-1000 printer (136 column, 300 cps) ... call

FX-866 printer (80 column, 240 cps) ... call

FX-2866 (136 column, 240 cps) ... call

LQ-850 printer (80 column, 264 cps) ... call

LQ-1050 printer (136 column, 264 cps) ... call

LQ-2500 printer (136 column, 324 cps) ... call

LX-800 printer (80 column, 180 cps) ... call

Printer-to-IBM cable (6 feet) ... 15.

5th Generation ... 6 months

Logical Connection 256k ... 319.

Logical Connection 512k ... 379.

Hayes ... 2 years

Smartmodem 1200 ... 299

Smartmodem 1200B (with Smartcom II) ... 299



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Smartmodem 1200B (no software)	\$265.
Smartmodem 2400	449.
Smartmodem 2400B (with Smartcom II)	449.
Hercules ... 2 years	
Hercules Color Card (CGA)	159.
Hercules Graphics Card Plus	189.
Hercules Incolor Card (includes RAMfont)	call
IMSI ... lifetime	
Genius Mouse (includes Paint; 1 yr. warranty)	49.
Optimouse (includes Dr. Halo II)	99.
Intel ... 5 years	
Inboard 386 (requires cable inst. kit)	949.
Inboard Installation Kit	139.
Aboveboard 286 512k	319.
Aboveboard PS/286 512k S/P	349.
80287 (for IBM-PC & XT)	114.
80287 (for IBM-PC AT & XT 286)	195.
80287-8 (for 8 MHz AT compatibles)	249.
80387 (16 MHz)	499.
Kensington Microware ... 1 year	
Masterpiece	94.
Masterpiece Remote	119.
Masterpiece Plus	109.
Printer Muffler (80 column)	39.
keytronic ... 3 years	
101 Keyboard (enhanced layout)	119.
Kraft ... 1 year	
Three-button Joystick	33.
Microsoft ... 1 year	
Mouse with Paintbrush (specify bus or serial)	99.
Mouse with EasyCAD (specify bus or serial)	119.
Migent ... 1 year	
Rocket Modem (ext., 1200 baud, w/software)	169.
MSC Technologies ... lifetime	
Formerly Mouse Systems Corp.	
PC Mouse w/PC Paint Plus (serial version)	99.
PC Mouse w/PC Paint Plus (bus version)	109.
NEC ... 2 years	
Multisync (800 x 560 max. res.)	547.
Multisync Plus (968 x 750 max. res.)	949.
GB-1 (supports 640 x 480 resolution)	279.
NSI Logic ... 3 years	
Epic 480 (extended EGA)	219.
Smart EGA Plus (supports 800x600 res.)	269.
Okidata ... 1 year	
Laserline 6	call
Laserline 6 RAM cartridge (384k)	239.
Personality Module (serial or parallel)	159.
Orchid Technologies ... 2 years	
Tiny Turbo 286	289.
PC Turbo 286 w/1 Meg (10 MHz)	729.
Jet 386 (includes cable kit)	869.
RAMquest 2 Meg (for PS/2 models 50/60)	699.
Practical Peripherals ... 5 years	
Microbuffer Mini (parallel print buffer w/28k)	79.
Microbuffer Inline (par. print buffer w/256k)	149.
1200 Baud Internal Modem	89.
1200 Baud External Modem	109.
2400 Baud Internal Modem	159.
2400 Baud External Modem	189.
Princeton Graphics ... 1 year	
MAX-12E (amber monochrome monitor)	139.
HX-12E (640 x 360 max. res.)	499.

Quadram ... 2 years	
ProSync (with mouse; supports 640x480 & 752x400 resolution)	\$259.
Microfazer II Print Buffer 64k	249.
Sony ... 90 days	
Multiscan (900 x 560 max. res.)	call
Toshiba ... 1 year	
P321SL printer (80 col., 216 cps, w/tractor)	529.
T1000 Laptop Computer	call
T3100/20 Laptop (w/20 Meg Hard Drive)	call
Tsang Labs ... 1 year	
EVA 480 (supports 640x480 res., includes Dr. Halo II & drivers for Autocad & Lotus 1-2-3)	299.
Video 7 ... 2 years	
VEGA Deluxe (supports 640x480)	259.

DRIVES

IOMEGA ... 1 year	
Bernoulli Box 20 Meg w/PC2 card	1649.
10 Meg cartridge	59.
Bernoulli Box 40 Meg w/PC2 card	1849.
20 Meg cartridge	82.
Miniscribe Corp. ... 1 year	
Scrite Card 30 Meg (68 ms)	479.
Mountain Computer ... 1 year	
40 Meg Internal Tape Drive (XT or AT)	379.
40 Meg External Tape Drive (XT or AT)	499.
40 Meg External Tape Drive w/Power Supply (XT or AT)	569.
DriveCard 20 Meg (80 ms)	479.
DriveCard 30 Meg (78 ms)	569.
DriveCard 50 Meg (54 ms)	699.
Plus Development ... 2 years	
Hardcard 20 Meg (49 ms)	call
Hardcard 40 Meg (39 ms)	call
Seagate ... 1 year	
FREE PCTV® Hard Drive Installation Tape with the purchase of Seagate drive for the IBM PC (not for AT). Specify Beta or VHS.	
20 Meg Internal Hard Drive (w/Western Digital controller and cables, 65 ms)	299.
TEAC ... 1 year	
PC, XT 360k Drive (5 1/4" half-height)	99.
Toshiba ... 1 year	
PC, XT 360k Drive (5 1/4" half-height)	99.
AT 360k Drive (5 1/4" half-height)	117.
PC, XT, AT 720k Drive (3 1/2", half-height)	119.

MEMORY

64k Upgrade Set (150 ns, set of 9)	call
256k Upgrade Set (150 ns, set of 9)	call
256k Upgrade Set (120 ns, set of 9)	call

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All disks have a lifetime warranty.	
5 1/4" DS/DD Disks for PC & XT (360k)	
Fuji MD2D (10 disks per box)	\$12.
Sony (10 disks per box)	12.
Maxell MD2-DM (10 disks per box)	13.
Verbatim Datafile (10 disks per box)	13.
5 1/4" DS/High Density Disks for AT (1.2 Meg)	
Fuji MD2HD (10 disks per box)	22.
Sony (10 disks per box)	23.
Maxell MD2-HDM (10 disks per box)	23.
Verbatim Datafile (10 disks per box)	22.
3 1/2" DS/DD Diskettes (720k)	
Sony (10 disks per box)	19.
Maxell (10 disks per box)	20.
3 1/2" DS/High-Density Diskettes (1.44 Meg)	
Fuji (10 disks per box)	55.
Maxell (10 disks per box)	59.

MISCELLANEOUS

CompuServe	
CompuServe Information Service	24.
Grolier's OnLine Encyclopedia	32.
PC Connection ... lifetime	
Computer Toolkit	22.
Smartmodem-to-AT cable (9 feet)	19.
15-foot Parallel Printer cable	19.

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- For all other items, add \$2 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.
- Hawaii:**
- For monitors, printers, hard drives, and computers, actual UPS Blue charge will be added. For all other items, add \$2 per order
- Alaska and outside Continental US:**
- Call 603/446-3383 for information.

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PC CONNECTION

■ EGA PLUS CARDS

TECMAR INC.

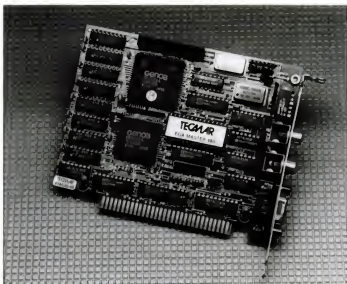
Tecmar EGA Master 480

Tecmar is one of the older companies supporting the IBM PC standard. It designed one of the first video adapters and helped introduce many PC users to the wonders of high-resolution graphics.

Now a division of Rexon, a holding company, Tecmar is selling two EGA Plus cards, which it designates as the EGA Master 480 and EGA Master 800. The names are a tip-off to the boards' resolution. Tecmar OEM's the EGA Master 480 from Genoa Systems Corp., and the card is similar to the Genoa SuperEGA (although it lists at \$495, \$4 less than the Genoa board), but some of the differences are significant.

The Tecmar board uses the Genoa chip set and a Genoa BIOS. This chip set includes hardware for normal CGA, MDA, and Hercules emulations. Plantronics ColorPlus emulation is available, too. The card is easily configured and allows access to its setup switches through the usual cut-out in the backplane. Installation is aided by Tecmar's fine documentation (superior to Genoa's), which includes extra sections on tips and troubleshooting. The installation of the card is just the normal plug in and run.

The board included the appealing and powerful mode-selection software designed by Genoa. A generous assortment of text modes is available, ranging from 80 by 60 and 80 by 66 up to 132 columns by 25, 29, 32, or 44 lines. You don't need to patch DOS or use a special driver for these to work correctly with DOS. You can run



The Tecmar EGA Master 480 uses the Genoa chip set and a Genoa BIOS. Included in the chip set is hardware for normal CGA, MDA, and Hercules emulations.

game software that bypasses DOS through an option in the mode software that boots a floppy disk directly.

Tecmar supplies drivers for *Microsoft Windows*, *GEM*, *AutoCAD*, *1-2-3*, and *Symphony*. The *GEM* drivers include a useful 640 by 528 resolution. A batch file for installing the board with *WordPerfect* is also provided.

In addition to the normal 640 by 480 EGA Plus *Windows* driver, Tecmar includes an unusual 800 by 440 *Windows* driver. This seemingly odd resolution actually makes a lot of sense. It retains the same pixel ratio as the standard EGA 640 by 350 resolution. It somehow felt more right than some of the other ratios available on other boards. Tecmar's 800 by 440 mode seems simply to have higher resolution without distortion. Overall, this mode showed less slowdown than other high-resolution modes on our performance tests. You don't pay much of a speed penalty for the extra resolution provided by 800 by 440. We like it!

Tecmar's *AutoCAD* driver is the same Creative Logic ADI driver you'll find in

■ The EGA Master 480 includes an unusual 800 by 440 *Windows* driver. This seemingly odd resolution actually makes a lot of sense.

other boards in this review. Its windowing functions were attractive and useful. Only the 640 by 480 mode was available with *AutoCAD*.

Other than the fetching 800 by 440 drivers, the Tecmar doesn't stand out from the EGA Plus pack. At \$495, you won't go far wrong with the EGA Master 480, but there are other EGA Plus cards you can choose from for the same money that also deserve your consideration.



FACT FILE

Tecmar EGA Master 480

Tecmar Inc.
6225 Cochran Rd.
Solon, OH 44139
(216) 349-1009
List Price: \$495

In Short: Unusual 800 by 440 *Windows* drivers provides very attractive results. Good driver support and moderate performance.

CIRCLE 887 ON READER SERVICE CARD

TECMAR INC.

Tecmar EGA Master 800

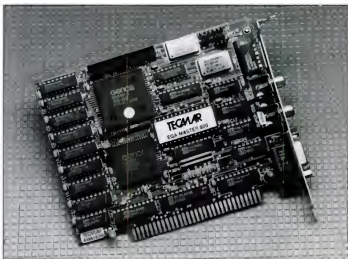
Tecmar's EGA Master 800 is similar to the Genoa Super EGA HiRes. It lists at \$595, \$4 cheaper than the Super EGA HiRes. No surprise since Tecmar OEM's the EGA Master 800 from Genoa. Like the Genoa, Tecmar's board is capable of up to 800 by 600 resolution with multiple-scanning-rate monitors.

The chip set performs CGA, MDA, Hercules, and Plantronic ColorPlus emulations in hardware. The EGA Master 800 also provides partial emulation of the new IBM VGA standard. It is compatible with most VGA software in modes 11 and 12 (the 640 by 480 modes), but not the 256-color 320 by 200 mode 13. VGA compatibility wasn't provided with the Genoa.

Like the other Tecmar/Genoa boards, installation is straightforward. There are some on-board jumpers that you may have to set if your configuration is unusual, but normally the switch accessible through the backplane is all you must set, if that. Tecmar's documentation is good, and installation presents no difficulties.

Tecmar includes the same drivers with the EGA Master 800 as with its lower-resolution cousin. The same 640 by 529 GEM drivers and the unusual 800 by 440 *Microsoft Windows* drivers are available, as is the Creative Logic *AutoCAD ADI* driver. You also get a fine setup utility and a wide variety of text modes, including the unusual high-density 100 by 75 and 114 by 60 displays.

The EGA Master 800 provides rock-steady 800 by 600 displays. It does not re-



The Tecmar EGA Master 800, a half-length card selling for \$595, is capable of up to 800 by 600 resolution with multiple-scanning-rate monitors.

duce the vertical-scanning rate, as do the ATI and Tatung boards, so there is no increase in flicker. Tecmar's documentation makes the strange assertion that "the Sony Multiscan monitor can support 640 by 480, but it cannot support 800 by 600 advanced high-resolution graphics." We disagree. Our results with 800 by 600 on our Sony Multiscan with both *Windows* and *AutoCAD* were exemplary. The images were totally stable, and we didn't have to make any positioning or size adjustments when switching into or out of the super high-resolution mode.

As with its Genoa equivalent, the *AutoCAD ADI* driver's special viewport features worked only in 640 by 480 mode, not 800 by 600. The special capabilities are useful and are missed in the high-resolution mode. Unfortunately, the extra high resolution uses up too many pixels of the 256K-byte video RAM, so there simply isn't room for the extra windowing features available in lower resolutions. The snazzy windowing is moderately useful, but we'd personally opt for the added clarity and detail of the 800 by 600 driver.

We had good results with *Windows* at 640 by 480, 800 by 440, and 800 by 600. 800 by 600 is significantly slower than ei-

ther of the other resolutions, but the added detail is a reasonable trade-off. You can try the various resolutions and decide for yourself.

The EGA Master 800's performance is right in line with its Genoa equivalent. It's a little slow but not horribly so.

Tecmar sells the EGA Master 800 for \$595, the same as the Genoa version with the same features. As we said in our evaluation of the Genoa, this price is reasonable when you consider the 800 by 600 capabilities.

THOMSON INFORMATION SYSTEMS CORP.

Thomson EGA Ultra Version

The concept of "one-stop shopping" works well in the supermarket trade, so why not in PC video? NEC, a pioneer in multisync monitors, markets an EGA Plus video adapter called the GB1 that lists for \$549 and is essentially a clone of Tseng Labs' fine Eva/480. Now Thomson Information Systems Corp., a company beginning to make an impact on the monitor market, has started offering an excellent EGA Plus card called the Thomson EGA



FACT FILE

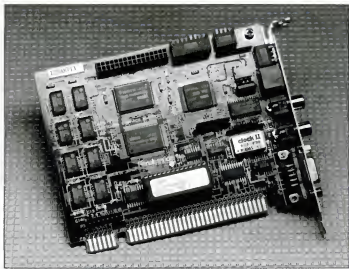
Tecmar EGA Master 800

Tecmar Inc.
6225 Cochran Rd.
Solon, OH 44139
(216) 349-1009
List Price: \$595

In Short: Superb 800 by 600 high-resolution mode and 800 by 440 *Windows* drivers. Performance was middle of the pack.

CIRCLE 66 ON READER SERVICE CARD

■ EGA PLUS CARDS



The half-length Thomson EGA Ultra Version board offers increased bandwidth to the video memory and supports the full set of 256 raster operations required by Windows.

Ultra Version, which lists at \$495.

The EGA Ultra has an unusual design, unusual chips, and unusual driver software. The design goal is to "function as a Windows engine." Thomson claims *Microsoft Windows* performance advantages because the board can perform read/modify/write operations in a single cycle and has automatic phase alignment for BITBLT operations. The board also offers increased bandwidth to the video memory and supports the full set of 256 raster oper-

ations required by *Windows*. The hardware also includes excellent cursor operation (up to 32 by 64 pixels), which reduces cursor flicker under *Windows* and further speeds operation.

The chip set is a proprietary ASIC VLSI developed jointly by Renaissance GRX, an OEM vendor founded by a group of ex-Microsoft employees, and Japan's Yamaha. It uses 1.5-micron CMOS (complementary metal oxide semiconductor) in a 100-pin surface-mount configuration. The chips incorporate all four existing graphics standards; the entire logic of both the 6845 CRT controller and EGA controllers resides in hardware, and the board can display gray scales on a monochrome monitor. This chip set also includes provisions for up to eight video planes (if 512K bytes of memory is provided), analog and TTL digital output, and frame-grabbing digitization of NTSC signals, although none of these advanced capabilities are implemented in the EGA Ultra board.

The EGA Ultra is the only board tested that includes an InPort interface, which accepts a Microsoft mouse with the appropriate round miniconnector (the same one used for Microsoft's bus and InPort mice).

This port can save you either a slot or a serial port, and you need buy only the mouse itself, which is less costly than the others.

The half-length EGA Ultra board features surface mounting on both sides for increased density. There were a couple of correcting wires, not unusual in an early production sample (serial number 33).

Because of the InPort facility, installation was slightly more complicated than it was for the other boards tested. As with a Microsoft Bus Mouse, you must select an interrupt level for the mouse. The presence of various devices in your system precludes certain interrupts, so finding a suitable one is something of a process of elimination. The factory default of 2 works in many, but not all, circumstances. The interrupt is selected via a jumper pad.

The EGA Ultra has a four-position switch accessible through the backplane that determines the monitor type and default mode. Two other switches modify other aspects of monitor interaction. These switches are thoughtfully positioned at the top of the card. Even though you must remove the computer's cover to get at them, they're more accessible than they would be if they were lower down. A supplied utility handles software installation unusually well.

Our test sample came with only *Windows* and *AutoCAD* drivers. The 1-2-3/ *Symphony* drivers weren't ready at this writing but were scheduled to be out soon.

IMPRESSIVE DRIVER We first tested the EGA Ultra with *Windows* installed with the standard *Windows* EGA driver. Performance was good but not exceptional. Then we tried the 640 by 350 driver provided by Thomson. Wow! This was a kettle of pixels. Most of the tests took a third to half the time, and one test ran five times faster! The arrow pointer and the hourglass were rock stable and didn't flicker when they intersected with other entities. One incidental oddity was that the Thomson driver didn't let us hit Return as a default in dialog boxes.

We were equally impressed with the 640 by 480 *Windows* driver. Most, but not all, of its operations in high resolution were significantly faster than standard EGA resolution without the special drivers. Strangely, high-resolution *Windows*



EDITOR'S
CHOICE

FACT FILE

Thomson EGA Ultra Version
Thomson Information Systems Corp.
5731 W. Slanson Ave.
Culver City, CA 90230
(213) 568-1002
List Price: \$495

In Short: Unique chip set and drivers provide stunning performance with *Windows*. Performance with other software is merely good. The Microsoft InPort can save a slot or serial port.

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**EDITOR'S
CHOICE**



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■ EGA PLUS CARDS

came up in black and white, which hadn't occurred in our test series. We were able to apply our color preferences with no problems, though.

The *AutoCAD* driver uses the common ADI interface, but unlike most, it isn't memory resident. Instead, it's an executable file that spawns *AutoCAD* after initializing the EGA Ultra board. After being so knocked out by the *Windows* drivers, we were slightly surprised to find that the *AutoCAD* driver is something of a slug. It's slow and doesn't offer any bells or whistles; it simply gets the board working with *AutoCAD*.

Performance on PC Labs performance tests was impressive. The Ultra EGA was a close second to the Paradise board in teletype text testing, which indicates how well a board will display normal text.

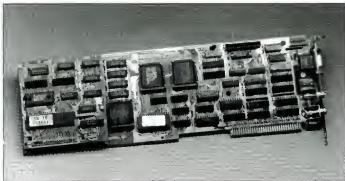
If all this performance exacted a premium price, we'd still recommend the Ultra EGA. But it doesn't! The \$495 retail is highly competitive. If you're not a *Windows* user, the Ultra EGA is acceptable, but there are other boards that offer resolutions above 640 by 480 for the same money or less. But if you do use Microsoft's pride and joy interface, there's absolutely nothing in this category that can touch the Thomson EGA Ultra!

TSENG LABORATORIES INC.

Tseng Labs Eva/480

Tseng Laboratories was one of the first to design an advanced chip set emulating the EGA and to offer an EGA Plus card with 640 by 480 resolution. Its Tseng Labs Eva/480, which lists for \$580, has garnered a reputation for high performance and flexibility, which we found to be well justified.

The Eva/480 is a full-length, heavily populated adapter. The Eva/480 comes standard with Tseng's CMII daughterboard option. Without the CMII, the Eva/480 is just as compatible with CGA and Hercules software as an IBM EGA adapter. The IBM EGA runs most, but not all, CGA software, and it's downward compatible with the CGA. So is a Tseng without the CMII module. With it, however, the Eva/480 becomes completely compatible with both CGA and Hercules software. You may also want to investigate



The Tseng Labs Eva/480, a full-length heavily populated adapter, lists for \$580. With its CMII daughterboard option, the Eva/480 is completely CGA and Hercules compatible.

NEC's \$549 GB1, an OEM version of this board.

You also get a parallel port with the Eva/480. If you install a monochrome adapter, the Tseng's parallel port functions as LPT2; otherwise it's fixed as LPT1. You may have to readdress a parallel port on your multifunction or I/O card. The parallel port is an attractive extra at seemingly no extra cost.

You set text modes with a simple utility called Emode. Tseng also supplies a customized replacement for ANSI.SYS called EANSI.SYS. If you don't include EANSI in your configuration file, the various Tseng text modes don't override DOS's 25-line display limitation. The utilities included with some other boards automatically operate with DOS in whatever mode you've chosen. Tseng's method is

less desirable, since you can't use some other ANSI driver or, for that matter, no ANSI driver at all.

Other software is included at no cost. A powerful font editor lets you modify several supplied fonts or create brand-new ones. For some reason, it operates in CGA mode, but it's unusual and useful nonetheless. You also get a competent print spooler, although many users probably already have one.

One feature that sets the Tseng and its NEC, QDP VIVA, and other OEM board equivalents apart is hardware pan and zoom. The hardware design lets you zoom in and out and pan the graphics image strictly within the board's hardware, not dependent on any zoom or pan capability of the applications software you're running. A RAM-resident utility that you call up with a hotkey (which you can define so it doesn't conflict with your applications software) displays a small box with arrows to remind you that the hardware zoom and pan is active. You use keys on the cursor pad to enlarge or reduce or pan the screen image. This works beautifully (we tested it with *AutoCAD*, *Microsoft Word*, and several other graphics programs) and is an attractive enhancement not offered by other board makers.

DR. HALO As if this weren't enough, you also get a copy of *Media Cybernetics' Dr. Halo II*, an excellent paint program that hasn't achieved the recognition it de-

**EDITOR'S
CHOICE**

FACT FILE

Tseng Labs Eva/480
 Tseng Laboratories Inc.
 10 Pleasant Run
 Newtown, PA 18940
 (215) 968-0502
List Price: \$580

In Short: Stands out for hardware pan and zoom and very good performance. The board has a free font editor and includes *Dr. Halo II* paint software.

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■ EGA PLUS CARDS

serves. Besides the normal paint tools, *Dr. Halo* includes powerful text manipulation features, curve fitting, and an image grabber that can capture images from *I-2-3*, *AutoCAD*, and many other programs for graphics enhancement. It supports the Eva/480's hardware zoom and pan, as well as the full 640 by 480 screen resolution.

Tseng's selection of applications soft-

■ Tseng's *I-2-3* and *Symphony* text drivers are easy to use. When you start *I-2-3*, for example, a screen appears that lets you choose the text layout you want.

ware drivers is reasonably extensive. A bare-bones but functional *AutoCAD* ADI driver doesn't make much use of color and doesn't offer any advanced features, but it works. Similarly, the *Windows* driver gets the job done, but only at 640 by 480.

Tseng's *I-2-3* and *Symphony* text drivers are unusually easy to use. When you start *I-2-3*, for example, a screen appears that lets you choose the text layout you want, including 80 by 25; 132 by 25, 28, or 44; and 80 by 60. You can also change the modes from within *I-2-3*, but you have to quit and restart for them to take effect.

The Eva/480, along with Video-7's VEGA, was one of the first EGA Plus cards available. As a result, there are quite a few third-party programs that make use of the board's capabilities. For example, we often use a shareware utility called *NewFont* that offers a variety of screen fonts and excellent palette control.

The Eva/480 is a relative old-timer, but it was a frisky youngster in many of our performance tests. It was no worse than middle of the pack on our *AutoCAD* and *Windows* performance tests, but on our blitz, random block, and line pattern tests, the Eva/480 (and its OEM cousin, the

QDP VIVA) was among the three fastest boards tested.

At \$580, the Eva/480 is no longer all that competitively priced, especially without resolutions higher than 640 by 480. It's far from out of line, though, when you consider the zippy performance and all the extra software you get in the package. Tseng will be releasing some hot VGA boards later this year, but the Eva/480 is likely to remain a contender for some time.

VIDEO-7 INC.

Video-7 VEGA Deluxe

Video-7 is one of the leading suppliers of PC video adapters. It supplies, for instance, the boards sold by Quadram as the \$495 ProSync. Video-7's original VEGA and the newer VEGA Deluxe reviewed here have built quite an enviable reputation for their performance and reliability, as well as an extremely impressive sales record.

The VEGA Deluxe lists for \$495 and is an elegant half-length card that uses almost all surface-mount technology (only the ROM BIOS is a socketed standard chip). Video-7 pioneered the idea of making the



FACT FILE

Video-7 VEGA Deluxe

Video-7 Inc.
46335 Landing Pkwy.
Fremont, CA 94538
(800) 238-0101
(415) 656-7800
List Price: \$495

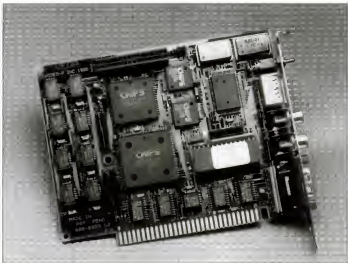
In Short: Good drivers but moderate performance from this polished and popular video adapter.

CIRCLE 1 ON READER SERVICE CARD

configuration switch accessible through an opening in the backplane, and the VEGA Deluxe card includes this very sensible, handy feature.

You set an external switch on the backplane to specify whether the VEGA will be connected to either an EGA monitor or a CGA/MDA monitor. This is convenient if you change monitors (other boards often make this adjustment via an internal jumper).

Both hardware and software installation are easy, aided by a simple utility. A



The Video-7 VEGA Deluxe, a half-card selling for \$495, includes an external switch on the backplane to specify whether you're connecting it to an EGA or a CGA/MDA monitor.

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CIRCLE 498 ON READER SERVICE CARD

■ EGA PLUS CARDS

straightforward command-line utility lets you specify whether to emulate a type of monitor or activate a screen saver. The VEGA Deluxe now incorporates an auto-switching system to automatically select the appropriate video mode for your applications software.

A new option that seems to allow a MultiSync monitor to run Hercules graphics mode in color is misleading. When you run the new command, you're informed that all that happens is resetting the pal-

■ **Video-7 handles**
game disks that must boot
directly in an interesting
way. You can create
a "preboot floppy disk"
containing a special
VEGA driver.

ettes, and you're warned not to run Hercules graphics mode programs. We tried a Herc graphics program anyway, but, as advertised, it didn't work.

Video-7 handles game disks that must boot directly in an interesting way. You can create a "preboot floppy disk" containing a special VEGA driver. When you boot with this disk, it sets up the VEGA in the video mode you've specified and prompts you to insert your game disk. **Neat!**

Video-7 provides 25- and 43-line text drivers in both 120- and 132-column configurations. The 132-character modes require a MultiSync, although you can use the 120-character modes with any EGA monitor. It's thoughtful of Video-7 to provide both options, but some other boards can display the full 132 columns on standard EGA monitors.

The EGA Monitor driver is the Creative Logic ADI driver used by several other EGA Plus boards. It includes a Viewport option that lets you store a view of your current drawing and display it in a small

window. You can thus display two different views simultaneously. Two menu files are provided to add the necessary commands to AutoCAD's menu structure, one for AutoCAD, Version 2.18, and one for Version 2.5 and later. Several subcommands let you capture up to two-thirds of the screen (due to memory limitations), recall the stored view, position it to any corner of the screen, scroll the image inside the Viewport, and set the scroll rate within the Viewport image.

Modes 11 and 12 of the VGA standard are supported. A new VEGABIOS.SYS file is installed as a device driver in your CONFIG.SYS by a utility that will add to an existing CONFIG (if you already have created one).

USEFUL UTILITIES Instructions and/or patches are provided for WordPerfect and WordStar, Versions 4.0 and 3.3. Video-7 also supplies two handy utilities, one to change palette colors and the other to change the board's switch settings via software. This handy utility saves you the trouble of having to physically move the switches yourself.

Video-7 planned to begin running a bulletin board this fall. The number to call is (415) 656-0503. You will be able to ask tech-support questions, as well as download software upgrades and additional drivers.

Our tests of Windows in standard 640 by 350, 640 by 480, and 752 by 410 modes were uneventful. The drivers installed as directed and worked as expected. The same applied to AutoCAD in the same three resolutions.

Video-7 may have been one of the companies that pioneered EGA Plus boards, but the VEGA Deluxe no longer sets any performance standards. It was on the slow side on most of the performance tests we put the board through.

On the other hand, the VEGA is a very polished board. We didn't run into any of the driver glitches, rolling screens, and other oddities that sometimes occurred with other boards. The drivers were easy to install and operated smoothly.

Video-7's early entry into the EGA and EGA Plus categories shows in the maturity of both the hardware and the software. Even if it doesn't stand out from the pack,



EDITOR'S CHOICE

- Paradise AutoSwitch EGA 480
- Thomson EGA Ultra Version
- Tseng Labs Eva/480


There really wasn't a weakling in this bunch. But three boards stood out from the rest—the Paradise AutoSwitch EGA 480, the Thomson EGA Ultra Version, and the Tseng Labs Eva/480.

The \$495 Thomson EGA Ultra is the clear choice if you run Microsoft Windows. The EGA Ultra was designed to optimize Windows, and it does exactly that. The EGA Ultra was by far the fastest adapter with Windows, although its performance with other software packages was merely middle of the pack.

The Tseng Eva/480, which lists at \$580 and is also available as the NEC GB1 for a list price of \$549, is an all-round solid performer. It was among the fastest on several of our tests. Its hardware pan and zoom can be very useful with appropriate software, and it comes with an excellent assortment, although it doesn't provide any resolutions higher than 640 by 480.

The \$479 Paradise AutoSwitch 480 offers excellent text-mode performance, a significant advantage for the myriad of text-based software applications we all use every day. Its auto-switching and automatic monitor detection features are convenient, and its documentation is first-rate. But it, too, works only up to 640 by 480.

Each of these boards delivers fine performance at a reasonable price, and they all offer exciting resolutions and improvements.

the VEGA Deluxe is still competitive in most respects. 

Glenn A. Hart is a contributing editor of PC Magazine.

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LAN Analyzers



Of course, all computer equipment is subject to operational problems. But when a LAN goes bad, uncovering the source of the trouble can be a daunting task because of the complexity, and often the sheer number, of the components involved. Now the LAN analyzer offers an alternative to stumbling blindly through the intricate maze of a malfunctioning network.

LAN analyzers are like electrocardiographs for LANs. They monitor the electrical impulses traveling over the nervous systems of networks and then provide a statistical and sometimes graphic view of network operations. The typical LAN analyzer, however, is much more sophisticated than an EKG and provides more-detailed processed data. To approximate the capabilities of a

Four analyzers—from 3Com, Excelan, Hewlett-Packard, and Network General—apply high-tech diagnostics to network ailments. But like medical treatments, they come at a price—about \$18,000 on average.

FRANK J. DERFLER, JR., AND GREG CAMPBELL

LAN analyzer, a medical diagnostic machine would have to provide a broad-spectrum analyzed picture of the individual in real time and let the physician press a button to watch the action of a specific organ.

These network diagnostic tools allow you to see every byte in the packets that are whizzing (or crawling) through your LAN. You set parameters telling the analyzer what packets and portions of packets to capture. Once the analyzer has collected this data, it does a statistical analysis and shows you charts, diagrams, and pictures of the packets. Sometimes it will also tell you whether or not the results are OK.

These specialized products are expensive, but they can pay for themselves in terms of reduced user frustration and increased LAN performance.

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And frequently they may be the only practical means for resolving problems that require delving into the intricate inner workings of a network, especially if internetwork protocols are involved.

Analyzers are both troubleshooting and operational analysis tools. The few true LAN hackers couldn't work without them. As troubleshooting tools in technically skilled hands, analyzers can help to determine if problems stem from hardware or software. They can quickly spot malfunctioning hardware and bad connections. Detailed analysis can uncover software anywhere in the system that isn't doing its job. As analysis tools, they can depict the workload of a server, workstation, or group of network nodes to determine who is loading down the network or how a node is performing.

Here we examine the features that are important in selecting a LAN analyzer and then take a close look at state-of-the-art offerings from Excelan, Hewlett-Packard, Network General, and 3Com. Even if you don't need one of these products now, just knowing they are available in the event of future problems could give you some valuable peace of mind.

WHO NEEDS IT? With an average price of \$18,000 (although the 3Com system is under \$1,000), a network analyzer won't fit into everyone's budget. The approximately 2,000 units sold have generally been the acquisitions of developers, field service reps, network administrators, and even corporate spies.

People who develop software or hardware for use on LANs frequently need to see what is going on inside the network. They can use the analyzer to determine the best packet sizes for optimum network performance and to monitor the action of hardware and software modules. They can also test their product against others under controlled network loadings and play and replay sequences of packets to improve the performance of their product. Without a network analyzer, developers would grope in the dark for clues to network operation and performance.

Field service reps will find some of the most profitable uses for this type of product. A person called on to diagnose failures or slowdowns of LANs at client sites can

use an analyzer to determine the problem quickly. Even hard-to-pin-down sporadic problems are easily traced with a LAN analyzer set up for long-term monitoring. Once it has uncovered the cause of a performance slowdown, the analyzer can then be used to monitor the effectiveness of corrective measures taken and thus justify any extra expense they entail.

Many new buyers of network analyzers come from the ranks of those entrusted with operating and maintaining corporate LANs. On a single LAN with more than

■ With an average price of \$18,000, a network analyzer won't fit into everyone's budget.

30 nodes or in an environment with LANs, bridges, and gateways, a LAN analyzer can make it much easier for a busy network administrator to keep things running smoothly.

Since a LAN analyzer has the capability to capture and inspect all packets of data moving through a network, it is an excellent tool for corporate espionage. Give someone the opportunity of physically tapping into your Ethernet or Token-Ring cable, and that person can easily trap all the log-on IDs and passwords transmitted through your system and browse through the data sent to or from a particular workstation or server.

One bank found this out during a LAN analyzer demonstration. Noticing an unused Ethernet connection on the conference room wall, the demonstrators attached it to the analyzer. The bank managers soon saw *their* data flashing by on the screen. This should be enough to make users dealing with sensitive data think about installing an encrypted LAN—or at least prompt them to be sure they know exactly where their cable runs and who has access to it.

USING THE TOOL What types of problems can you solve with a LAN ana-

lyzer? With adequate training and experience, you can handle just about anything you run up against. Fortunately, most analyzers come with helpful guides providing real-life examples, and most manufacturers offer optional training courses.

LAN problems can come in the form of a total failure, a partial failure, or a degradation in performance. A total network failure is usually traceable to some kind of hardware problem—a bad cable, a bad server, or a bad network interface card. Partial failures can arise from faulty equipment or improper software configuration.

The most frustrating problem on an Ethernet network can be a bad cable. When people move PCs, they sometimes disconnect the T-connectors from the network cable instead of from the computer, thereby creating a break in the cable. Another common source of trouble is a cable damaged or pierced by a nail during construction. Even without any mistreatment, the center conductor sometimes comes out of a T-connector, and connectors can corrode. A LAN analyzer lets you quickly test for and locate any of these conditions.

The cable test function on a product such as the Sniffer or Ethernet Analyzer tells you the distance to the bad spot on your cable. If you used the analyzer to determine each tap's distance from a known port when the network was working properly, the cable test can then lead you straight to the problem area. Without an analyzer, you would need to disassemble the network at various points in a binary-search fashion until you isolated the bad section. Or you could run around with an ohmmeter checking resistances across the cable's conductors and connectors until you found the fault. Obviously, the LAN analyzer route is the easier way to go.

Performance degradation is another problem that is best rectified with the help of an analyzer. Performance rarely deteriorates because of a poor cable or connections, but it can be undermined by some seemingly innocent piece of software. Slowdowns can also result from improperly setting parameters while installing networking software or creating the workstation boot disks. Sometimes the problem lies in the design and implementation of your applications software. Just because a program will run on a network does not

mean that it will run efficiently on a network.

Fine-tuning a network can allow a greater number of users to share it without resorting to more equipment and thus more expense. A network analyzer will quickly show you where the bottlenecks are in your applications and what inefficiencies are peculiar to your networking software. After improving the way you use your existing software and hardware, you might find that you don't need to upgrade your poorly performing LAN after all.

For example, where you hold files on a LAN can dramatically affect its performance. When you're dealing with applications such as PC databases that manipulate extremely large files, it is frequently more efficient to copy files from the server to a local hard disk than to pull large files continually through the network. An analyzer can show you the load on a particular file server so that files can be arranged for the most effective operation.

Network analyzers are also good for focusing on peculiar problems that defy an obvious solution. We resolved problems ranging from incorrect chip addresses on a server (somebody had pried out the old ROM chip containing the server address and replaced it with a newer one) to a .BAT file that was calling up a program and receiving the older .COM version instead of the newer .EXE version from the server. By quickly fingering the guilty party in these and other cases, the LAN analyzer earned its keep several times over in our networking toolbox.

INSIDE THE ANALYZER The first network analyzers were created by the manufacturers of network interface cards (NICs) for the purpose of monitoring their products' performance. Analyzers on the market today are more powerful, designed for a broader range of applications, and easier to use than the early specialized tools, but the fundamental principle behind them remains the same.

The NIC is at the heart of every PC-based Ethernet or Token-Ring network, plugging into the expansion bus of each PC workstation to let it communicate with the network. Every card has a unique station address used to identify the packets of information it generates. The software



LAN Analyzers: Summary of Features

(Products listed in ascending price order)

	EtherProbe Network Utility \$995	Hewlett-Packard 4972A \$17,000	Ethernet Analyzer \$19,500	Sniffer \$24,000
Works with Ethernet/ Token-Ring	Ethernet	Ethernet	Ethernet	Both
User can add protocols	○	●	○	●
LAN management functions	○	●	○	○
Computer used	PC/XT/AT	Proprietary	Compaq portable*	Compaq portable
AT clock speed	Depends on computer	N/A	6 MHz	8 MHz
Size of capture buffer	Depends on RAM	1 Mbyte	1 Mbyte	256K
Operating system	DOS 3.1	Proprietary	DOS 2.0	DOS 3.1
Split-screen viewing	○	●	○	●
No. of node names	1,000/library	1,000/library	100/file	1,000/library
Cable test	○	○	●	●
Decodes all layers of protocol	○	○ [†]	○	●
Ease of use (1-5)	3	4	3	4
Coexists with other Ethernet boards	○	○	●	●

○ — Indicates Editor's Choice

● — Yes ○ — No

N/A — Not applicable; Hewlett-Packard 4972A not DOS compatible

*Also available as a "kit" for a 6-MHz AT compatible or for any PC.

[†]Coffee layers can be defined by user but are not displayed simultaneously on screen.

running in each workstation determines what the NIC does with the data it receives from the network. But the specialized LAN analyzer software can control almost any NIC and monitor and report on the activity of all packets rather than just those addressed to that particular NIC.

Except for 3Com's software-only *EtherProbe Network Utility*, all the analyzers reviewed here consist of both software and hardware. Excelan's Ethernet Analyzer comes either as a kit (software and specialized Ethernet adapter card) or as part of a preconfigured Compaq Portable II computer. Network General's Sniffer comes preinstalled in a Compaq Portable II and is available for Token-Ring or Ethernet networks. Hewlett-Packard offers its Ethernet analyzer, the HP 4972A, installed in a proprietary Motorola-based portable computer system.

The fully configured implementations offered by Excelan, Network General, and Hewlett-Packard range in price from \$17,000 to \$24,000, and each gives you a portable computer (all AT compatible, except the HP, which is not an MS-DOS machine), a specialized NIC, and customized software that you can use to track down most any network problem you might encounter. These products differ from one another primarily in terms of features and ease of use. Careful consideration of the features offered should therefore be the prime concern when shopping for a LAN analyzer. The following section should give you an idea of what to look for:

Network Supported. Most analyzers support only Ethernet or Token-Ring networks, but the Sniffer, from Network General, comes in a dual-mode version. The Excelan Ethernet Analyzer can inter-

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face with either regular (thick) or thin Ethernet cable, depending on the type of external transceiver used.

Capture Rate. The capture rate represents the maximum number and size of packets that can be captured from the network. The analyzer should be able to accommodate bursts of data approaching the backbone (rated transmission) speed of your network. (One to 10 megabits per second is typical.) A useful feature can be the option to specify the amount of data captured from the packet. For example, you might want only the packet header information and perhaps the first 100 bytes of data.

Capture Filters. Filters set by the software let you specify which packets to keep and which to ignore. Ignoring irrelevant packets reduces the processing burden on the analyzer's NIC. Filters should let you select one or more nodes, particular times, specific bit patterns from any position within the packet, or certain series of events. An especially useful option is that of selecting packet collisions or packets with length or cyclical redundancy check (CRC) errors. Capture triggers should allow you to capture a specified number of packets before and after a given event occurs.

Buffer Size. Most LAN analyzers capture data in a RAM capture buffer rather than writing it directly to a local hard disk. The capture buffer can accept data at a much higher rate than even the fastest hard disk, so no packets are missed. The more RAM available (on either the NIC or an expanded memory card), the more data you can capture. Look for a buffer size of at least 500K bytes.

Disk Size. Every analyzer needs a hard disk to store data from the capture buffer for later analysis and to capture data during remote or delayed tests. While the analyzer's software may occupy only 1 or 2 megabytes on the disk, you will want plenty of space for storing data captured from your network. A 20-megabyte disk is the minimum. If your analyzer can capture to the disk as well as to the buffer, then having a fast disk drive (20 to 25 milliseconds) is also important.

Replaying Packets. Some analyzers let you replay captured (and possibly modified) packets on the network. This feature

is useful in analyzing intermittent or intermittent network problems that are difficult to replicate under normal conditions.

Network Traffic Generator. With a network traffic generator, you can specify the number and size of packets generated by the analyzer. This lets you simulate nearly any network loading up to 1,000 packets per second. Some generators allow you to specify the packet contents and address so that you can see how the network responds under various conditions.

Protocol Interpreters. Protocol interpreters allow the analyzer to display a decoded, or plain English, version of every packet in addition to its hexadecimal or binary representation. It is often necessary to view several layers of protocols within one packet, since many network functions—such as forming, addressing, forwarding, receiving, and decoding packets—operate according to different sets of protocols.

When buying an analyzer, find out which protocol interpreters are included and whether you can write your own supplemental interpreters. Which interpreters you will need depends on the networking software, bridges, and gateways that you decide to use.

Address Naming. Many analyzers allow you to replace station addresses with meaningful names, such as "Joe's PC" or "File Server." When you view packets on the screen or in printouts, the address naming function in the analyzer automatically substitutes the relevant name for the hodgepodge of numbers and letters that normally constitute the station address. The number of names allowed and the ease with which you can update them are important considerations when selecting an analyzer.

Cable Test. A cable-test capability lets you easily locate open connections or shorts in the cable by telling you how many feet away the fault is. It does this by means of a technique called time domain reflectometry, or TDR. The analyzer sends out a signal and measures the time delay of the reflection caused by the mismatched impedance in the fault. The results are given in milliseconds or are converted to a distance for specific cable types.

The TDR capabilities of these systems are simple to use and give valuable clues to

the location of cable problems. Unfortunately, the results are only approximate, with an error margin of plus or minus about 50 feet of cable, and they don't tell you the direction of the trouble. Ideally, you should repeat the test with the analyzer hooked up to a couple of different cable taps in order to isolate the problem more precisely.

Portability. If an analyzer can easily be moved from site to site, it will prove much more useful to a large organization. For a unit that will be frequently transported to different locations, a hard disk with automatic head parking is a good idea. The Compaq Portable II configurations offered by the Sniffer and the Ethernet Analyzer would be good choices for portability.

Training. One consideration you shouldn't overlook is that a LAN analyzer is only as good as the person running the machine. The availability of a training course might therefore be essential to making the analyzer a usable tool.

LAN Management. It's nice if your LAN analyzer can double as a LAN management tool, showing you who is using the network, determining average and peak utilization rates, and systematically identifying areas that need attention. The HP 4972A is the only analyzer that offers such capabilities. Without this analyzer, you would have to turn to new specialized products to get these features, although Novell, Microsoft, and 3Com are enhancing the LAN management functions of their networking software.

EXCELAN INC.

Ethernet Analyzer

The Ethernet Analyzer, from Excelan, is a powerful tool for monitoring, debugging, and characterizing LANs. This analyzer comes either as a kit (EX 5000E) or preinstalled in a Compaq Portable II computer (EX 5000EP). There is no difference in performance or features between the kit and the Compaq configuration, since they both use the same components. Versions of the Ethernet Analyzer are now available for both the Ethernet and StarLAN product lines. We didn't test the StarLAN system, but it should have the same features as the Ethernet device.

The Ethernet Analyzer monitors net-



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The Connectivity Decision Guide for LAN Analyzers

The first three steps in the LAN analyzer decision process are simple. Certain alternatives are available to you if you need an analyzer for a Token-Ring or StarLAN network. Similarly, if you aren't willing to pay more than \$1,000, then you should opt for 3Com Corp.'s *EtherProbe Network Utility*.

A major consideration if you're looking in the above-\$10,000 price range is whether you want to see multiple nested layers of protocol decoded on the screen; this is the Sniffer's specialty. However, if you want to do long-term characterization of a network's performance, the strong programming, filtering, and analysis capabilities of the Hewlett-Packard 4972A are appealing. This unit, however, does not have cable-test functions.



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work traffic and captures, time-stamps, and stores packets or packet segments. You tell the system how to filter, trigger, capture, and store packets from your network. You can also generate network traffic, test for cable faults, and decode and print captured packets. You can modify captured packets and replay them on the system to verify protocol paths or debug software.

The heart of this analyzer is the EXOS225 Ethernet network analyzer board and Excelan's *Ethernet Network Analyzer* software. The EXOS225 board features an Intel 80186 CPU, an Intel 82586 coprocessor, and 1 megabyte of RAM. Because most packet processing is done on the EXOS225, the Ethernet Analyzer can capture packets without dropping any in all but the heaviest network traffic. The host PC's processor communicates only with the user, the disk, and the printer.

GETTING STARTED We tried to install the EX 5000E kit in an 8-MHz IBM PC AT but with no success. A careful reading of the manual finally revealed that the EXOS225 board will work only in 6-MHz ATs. On any machine with a faster CPU clock rate, you have to plug the



Excelan's Ethernet Analyzer kit is a \$9,500 package that includes the analyzer board and software. The same equipment complete with a Compaq Portable II sells for \$19,500.

EXOS225 board into one of the 8-bit expansion slots and let its connections for 16-bit data dangle unused.

Armed with this information, we started to reconfigure the many jumpers on the EXOS225 board for the 8-bit slot. Unfortunately, the EXOS board did not come with enough jumper clips to make all the necessary connections. After liberating some clips from several other boards, we were in business and everything ran very smoothly.

The EXOS225 board attaches to your network by means of a 20-foot cable with an external EXOS1100 Ethernet Transceiver on the end. The transceiver taps into your network cable and is available for either thick or thin Ethernet cable. Because the transceiver is separate from the board, you can use different transceivers to match different network cables. Be sure to purchase the correct type for your network, or both if you need them.

A program called LanzaRun initializes the EXOS225 board. Once the board is initialized, another program called Lanza runs tests against your network. You control the Lanza software by means of easy-to-follow screens. The six main screens are called Edit, Run, Trace, Statistics, Name, and

Cable. You move among screens and select options from them through function-key-driven menus at the bottom of each screen.

Once you have set all the filters, triggers, and other options, the settings are saved as a test file. The Lanza software can then run tests by using these files to configure the triggering, monitoring, filtering, data capture, and traffic generation functions. Tests can run automatically at a specified time, they can be programmed to run when a specific network event is detected, or they can be run manually.

The software distribution disk contains several preprogrammed test files, distinguished from other files by a .TST extension. Using DEFAULT.TST, you can jump right in and start analyzing your network. You can modify the test on the fly and then immediately rerun it to start capturing packets.

CAPABILITIES The Ethernet Analyzer has a wide range of capabilities for capturing and transmitting data. Eight receiving channels and six transmitting channels handle the data, and each channel is turned on and off independently of the others. You can name a channel according to the



FACT FILE

Ethernet Analyzer

Excelan Inc.
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San Jose, CA 95131
(800) EXCELAN
(408) 434-2300

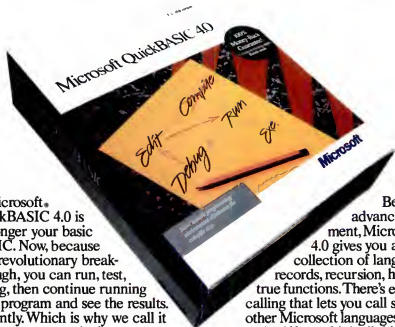
List Price: EX 5000E Ethernet Analyzer kit (analyzer board and software), \$9,500; EX 5000E/S (analyzer board, software, and ability to analyze StarLAN networks), \$9,995; EX 5000EP Ethernet Analyzer package (analyzer board, software, and Compaq Portable II), \$19,500.

Requires: EX 5000E Ethernet Analyzer kit: 6-MHz IBM AT or compatible using an 8-bit bus, 512K RAM, DOS 2.0 or later; Ethernet or StarLAN network. EX 5000EP Ethernet Analyzer package: Ethernet or StarLAN network.

In Short: A full-featured Ethernet LAN analyzer. Available as a kit that you install in your own computer, or preinstalled in a Compaq Portable II.

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■ LAN ANALYZERS

types of packets collected or generated. Thus, once you have set the filters and addresses properly for each channel, you can then refer to the server channel, the gateway channel, and channels for specific workstations.

Incoming packets are filtered as they are collected by a receiving channel. Filters can be set for packet size, error types, and data patterns (in either hex or ASCII character format). Additionally, for each channel you can specify whether to keep packet statistics for some, all, or none of the packets.

Criteria for one receiving channel can overlap with those of another and packets can be collected by more than one channel, depending on how you set the filters. Packets move into the RAM buffer at rates up to 1,000 packets per second (on a 6-MHz AT). In heavy network traffic with rates above 1,000 packets per second (or in excess of 700 kilobits per second), the Ethernet Analyzer may start missing some packets. Packets move from buffer to disk at a rate of 100 packets per second when you're using the EXOS225 in a 16-bit socket and 30 to 50 packets per second when you're using an 8-bit socket.

The six transmitting channels can replay particularly troublesome packets. Or they can generate network traffic to cause controlled network degradation—useful for developers and troubleshooters who often need to test a network under some artificial network load. You can specify the frequency, size, and content of the packets sent by the transmitting channels. Another rather clever feature lets you bypass the standard Ethernet back-off requirement (an interval of time that cards have to wait before transmitting after a collision) to force repeated collisions with other network packets.

When a test is running, you can capture packets either in the RAM buffer or to disk trace files. These files are automatically broken up into convenient 300K-byte segments that will easily fit on double-density floppy disks. From a single test, you can store up to 10.5 megabytes of packet traces and up to 10.5 megabytes of statistics. (The number of packets depends on packet size.)

You cannot observe the contents of packets while a test is in progress, but af-

terward you can use the trace screen to view the packets from either the buffer or a trace file. The trace screen is a split display with packet header information in the top half and one packet in detail in the bottom half. The window size is adjustable to show more or less detail. Packets are shown in hex and ASCII format, but no interpretation or evaluation of the protocol is performed at this level.

The LanzDSP program allows you to display packets of data from a trace file and identify the Transmission Control Protocol and Internet Protocol (TCP/IP) or International Standards Organization (ISO) protocol layers. This utility also formats the packets for printing.

The Packet Find command lets you quickly locate a packet based on a few criteria. You can then display either an absolute or relative time stamp of the packet, the packet number, and the filter criteria used to collect the packet.

The Ethernet Analyzer software lets you define names for each Ethernet station address. These can be up to 17 characters long and replace the 12-digit Ethernet station addresses when the contents of packets or packet headers are displayed or printed. Separate .NAM files can store up to 100 names each, and you can have as many .NAM files as you want.

CABLE TEST A single stroke of a function key takes you to the cable screen, from which you can test the connection to the transceiver, the transceiver itself, and the Ethernet cable. Trouble reports show the distance to any trouble spots in meters and feet, although shorts within 200 feet of the transceiver might not be detected. The cable test does not run continuously, so you must repeatedly enter the cable screen to see when a problem is corrected.

If you set the interrupt level, memory address, and DMA (direct memory access) settings correctly, the Ethernet Analyzer can coexist in a PC along with other NICs. This lets you have a workstation that doubles as a network analyzer.

For those interested in exploring some of the Ethernet Analyzer's features, a demonstration disk of the software is available. If you purchase this product, you can get a good introduction to it at the \$500 2-day training course offered by Excelan.

The specialized EXOS225 board used in the Ethernet Analyzer gives it commendable communications speed. The software allows a good deal of freedom in specifying filters and triggers but has a few limitations that leave it a cut below the competition. In particular, other systems offer better triggering functions and more help with interpreting and evaluating protocols for displayed packets. However, at only \$9,500 (plus an existing AT), the EX 5000E kit gives you relatively inexpensive entrée into fast and competent LAN analysis. The \$19,500 EX 5000EP package (including a Compaq Portable II), though, is less of a bargain compared with the competition.

HEWLETT-PACKARD CO.

Hewlett-Packard 4972A

Hewlett-Packard Co. has strengthened its entry in the LAN analyzer market with the new Hewlett-Packard 4972A. This portable LAN analyzer packs all the capabilities you will ever need for maintaining or analyzing your Ethernet LAN and offers powerful LAN management facilities not found in any other analyzer. HP also markets a respected line of wide-area network analyzers, and the HP 4972A reflects the maturity of those products.

The new HP 4972A supersedes the older model 7591S, which required you to buy each component separately and assemble them yourself. Now you can purchase a one-piece HP 4972A that you just



FACT FILE

Hewlett-Packard 4972A

Hewlett-Packard Co.
5070 Centennial Blvd.
Colorado Springs, CO 80919
(303) 593-8700

List Price: \$17,000; color option board,
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■ LAN ANALYZERS

connect to the network and turn on.

The 46-pound HP 4972A comes with a very crisp green monochrome monitor or an optional color display board. A remote RS-232 option allows you to connect two or more of these analyzers together. HP also offers a stylish travel pack with places to store minifloppy disks, cables, and cable transceivers.

One significant difference between the HP 4972A and other analyzers on the market is that the HP 4972A is not a DOS-based machine. It uses a Motorola 32-bit MC68010 microprocessor instead of an Intel CPU. It comes equipped with a 20-megabyte hard disk and two 3½-inch floppy disk drives, and an HP1B (IEEE 488) connector on the back of the machine lets you connect up to three other Hewlett-Packard hard disks.

Since the HP 4972A does not run DOS, you cannot use the machine as a workstation when it is not functioning as an analyzer or LAN manager. However, people managing larger networks will probably benefit by using the analyzer for management functions all the time, so the machine should be in almost constant use. In fact, this machine is the only one that could be of as much use to a network administrator as to a developer or field service rep.

A network administrator can use this tool to plot LAN utilization rates and error rates and to monitor the connections between specific nodes on the network. The administrator could turn the analyzer on in the morning and leave it running all day to record network use. Graphs of the data appear automatically on-screen in addition to being written to a file for later study. An HP ThinkJet printer or HP plotter can print graphs directly from the screen.

Network product developers and field service reps will find all the capability they need in the LAN analyzer functions of the HP 4972A. The network can be monitored interactively or through a built-in programming language. This language is driven completely by Hewlett-Packard's soft keys—a set of unlabeled keys just below the CRT that correspond to function prompts appearing directly above them in on-screen windows.

ANALYZER FEATURES The HP 4972A is a top-ranking LAN analyzer. It



Hewlett-Packard's 4972A analyzer and LAN management aid is not DOS based. Its microprocessor is the 32-bit Motorola MC68010. The system includes a 20-megabyte hard disk.



has all the features you would expect, except for a cable-testing function. We were told unofficially that the cable-testing functions available in other systems are not accurate enough to meet Hewlett-Packard's standards. The company's attitude seems to be that if you really want to do time domain reflectometry testing, you should buy a highly accurate specialized device.

You control console operation of the HP analyzer with soft keys that work like the function keys on a PC. The screen layout and keyboard options make it easy to operate the HP 4972A.

An analyzer's data capture rate and filtering capability are what determine its real value. The HP analyzer can capture data packets in its 1-megabyte buffer at rates in excess of 1,000 packets per second. Separate communications processor chips help speed up the transmit and receive functions, allowing the analyzer to operate reliably at high transmission rates. Packets are time-stamped in increments of 32 microseconds.

The user can define 16 separate filters to capture packets from the network. Hewlett-Packard has implemented these filters in the communications processor chips to speed up the filtering process and take some of the load off the analyzer's proces-

sor—although it would be hard to load down this unit's extremely fast 32-bit microprocessor.

To define a filter, you first give it a filter name. Then you identify the bytes or groups of bytes within the packet that you want to compare against criteria you set up. Each filter can compare 14 bytes in the header and 46 bytes throughout the rest of the packet. Once you have named each group of bytes, the resulting filter format is used to display or edit packets captured or transmitted on the network. These filter formats are also used by the LAN management functions to classify packet protocols.

A feature not found in most analyzers is the HP 4972A's capacity to specify filters at the bit level as well as the byte level. You can display a binary representation of the bytes you want to compare and specify whether a bit must be 0, 1, or a Don't Care. For example, 1xxxxxxx directs a filter to capture any packets with a 1 in the bit furthest to the left, regardless of what the other bits are. This would be difficult or impossible to do with most other analyzers.

Another unique feature is the self-contained programming language that controls the analyzer's functions. You can use this language to set up straightforward, English-like programs to perform func-

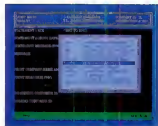
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THE MESSAGE COMES IN PIECES OF PACKETS

The best way to understand how a network functions is to take a close look at its most basic unit—the individual electronic message that it transmits from one node to another. A network analyzer works by capturing the messages sent along the network, sorting them according to criteria you establish, and presenting them for analysis and review.

In the Ethernet system, these messages are called packets or, sometimes, frames. A packet consists of at least 72 and not more than 1,526 bytes and is broken up into fields, each with a specific function.

All of the fields in a packet are of fixed length, except the data field, which carries the specific text of the message. This field can vary in length from 46 to 1,500 bytes.

The 8-byte destination field designates the station or stations the packet is addressed to. Every station on the network examines the destination address of every packet. You can program a network analyzer to keep only packets addressed to certain stations or to hold all packets. Similarly, the source address field identifies the station originating the packet, and an analyzer can use this to select only packets transmitted from a specific station.

The same Ethernet packet format carries messages between several different functional layers of hardware and software. Each of these functions requests

and provides information according to specific rules, or protocols. The protocols commonly used in Ethernet are part of the Xerox Network System (XNS), since the Ethernet system was developed by Xerox, DEC, and Intel. The type field in the packet consists of 2 bytes that identify the higher-level protocol that placed a message in the data field. A network analyzer can filter out and keep only packets containing certain protocol messages.

The protocol layers include the network protocol that forms messages for transmission, the routing protocol that moves packets through the network or between different networks, and the transport protocol that ensures packets are received without error and in the proper order.

Various companies and standards organizations have different implementations of these protocols. While the XNS protocols are the most widely used, new protocols following the International Standards Organization (ISO) guidelines are receiving a lot of attention. The Transmission Control Protocol and Internet Protocol (TCP/IP), which was originally developed by the Department of Defense, is another protocol suite that's growing in popularity.

Looking at the data fields of transport-level packets going to and from the server can tell you a great deal about the efficiency of the network. If packets must be

retransmitted frequently, you know something is wrong in the network. Watching the messages from the server can tell you if the problem is electrical (bad cables) or in the server. Frequent negative acknowledgment messages from the server indicate a bad cable. Frequent time-out and dropped-packet messages from the server probably mean that the network is overloaded.

While messages (tokens) on a Token-Ring system are formatted in a completely different way, the concept isn't very different from that of Ethernet's packets. In fact, the network analysis concepts are nearly identical. In both cases, you program filters to select and keep the messages you want and use other devices, such as counters, to determine how often a specific event takes place. This gives you either a statistical picture over time or a detailed picture of network performance at any given moment.

Network analysis isn't mysterious. It is simply the accumulation and analysis of statistical information. Some of the terms seem imposing, but the concepts behind them are as simple and common as those used to deliver the mail or freight packages to your door. There are shipping instructions, receipts, and the messages themselves. Analyzing the system is nothing more than examining how quickly and efficiently it moves the mail.—Frank J. Derfler, Jr., and Greg Campbell

tions other analyzers can't—such as storing all frames until the buffer is full. Other analyzers use a circular buffer and will overwrite data until you tell them to stop.

The HP programming language allows you to define variables and program event counters. The analyzer can count specific events and branch to different program blocks, depending upon simple or complex conditions. For example, a simple program could wait for a certain type of packet and then send a response while keeping timers and running counters on all

the pertinent events. While the programming language is powerful enough to meet the needs of any developer, LAN managers won't need it often because of the many LAN management features and reports already built into the system.

TRAFFIC GENERATOR The HP 4972A contains a network traffic generator. With this generator, you can specify the amount of network loading you want, as well as the size and contents of the transmitted packets. You create packets by fill-

ing in the fields using the filter format, which lets you easily and accurately enter all the data into the correct bytes of the packet.

An unusual characteristic of the HP traffic generator is its capacity to generate network traffic in repeated bursts, as well as at a steady level of output. Once you start the network traffic generator, you can leave it running and proceed to other analyzer menus and tests or perform LAN manager functions.

The HP 4972A connects to your net-

work through an external transceiver, so it can work with thin cable, thick cable, or fiber-optic media if you buy the appropriate transceiver. A simple loop-back self-test checks the analyzer, the cable link to the transceiver, the transceiver itself, and network operation. With one keystroke you can be sure everything is connected properly and operating.

All the powerful capabilities of the HP 4972A have not kept Hewlett-Packard from overlooking the little touches that make the product very usable. You can save network files containing all the information necessary for operating the analyzer in a specific configuration. Or you can save the information on how you set up the filters, transmitted messages, and programs in separate files for reuse in other configurations. The system lets you sort node name files by name—a feature especially important when you have hundreds of node names in the list.

■ **An area almost universally overlooked by LAN product manufacturers and users alike is network management.**

Since LAN analyzers inherently pose some threat to network security, the HP 4972A offers security features to give unauthorized people only limited access to its capabilities. It can password protect the display and transmission of packets. It can also be configured so that a user must enter

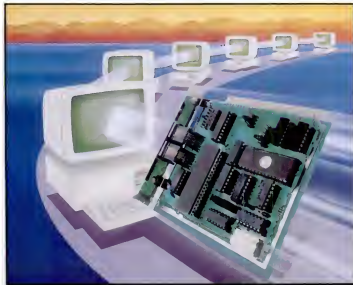
a password before being able to display data from a packet. Without this password, the user can still run the analyzer but can view only packet addresses and other header information. A second, Transmit Data password prevents unauthorized users from reading network passwords and messages or formulating and transmitting bogus packets.

NETWORK MANAGEMENT An area almost universally overlooked by LAN product manufacturers and users alike is network management. Typically, nodes are added, software is installed, and the work load is increased without much planning. Often the only time people think about managing the LAN is when response time deteriorates.

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■ LAN ANALYZERS

4972A can help you to some degree in all of these areas.

In the realm of security, if an analyzer is a good tool for spies, it is also good for counterspies. It is relatively easy to set up a filter that traps and even alerts you to requests for certain information or functions.

The HP 4972A allows you to test your LAN's performance while things are running smoothly and to anticipate and correct problems before the users start complaining. If a network gets too large or becomes unresponsive, the analyzer functions of the HP 4972A will let you determine what's wrong and what you can do to speed your network up. You could then use the reports from the HP 4972A to help justify any new acquisitions.

You collect management data by running what Hewlett-Packard calls a test. After you specify the time, duration, and sampling rate of the test, data accumulates and charts develop as you watch. Data can

then be saved to floppy disks or a hard disk for later analysis or replay.

Test results are displayed as line, bar, or pie charts, as well as in histograms and tabular data summaries. Each chart typically has a cursor allowing you to select data items on the graph and see the node name or other associated values. A \$1,500 color option board brings the charts to life with even easier-to-read graphics. With an HP plotter attached, you can also produce plotted color charts in no time at all.

This typifies the easy-to-absorb graphic form in which the HP 4972A presents the otherwise almost overwhelming amount of data provided by its management functions. Like other systems, the HP 4972A has a network summary screen that shows you current, average, and peak utilization and throughput. You can also see the minimum, average, and maximum packet size, as well as the total number of packets and bytes. You see the packet numbers, aver-

age and peak error rates, and other details concerning collisions, runts, jabbers, and bad frame check sequences or misaligned packets.

The network errors and conditions screen can display the average number of collisions per frame over a given test period. You can use this screen to spot and track any unusual trends in the number of errors on your network.

The network utilization screen shows you a line chart representing the actual usage of the network at each sample time. You can watch this chart as it is plotted and become familiar with user work habits, cyclic tendencies in peak or slack periods, and applications usage. You can correlate complaints from users about response time to this chart to see what the utilization was during the time of the complaint.

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■ LAN ANALYZERS

Monitoring this is important because a node can drop data if the packets come too quickly for it to process them.

An interesting management function measures the size of the frames (packets)

transmitted through the network over a period of time. The data field of a packet will expand to its maximum size of 1,500 bytes if a lot of data has to be moved. File transfers will typically load down a network

with packets expanded to over 1,000 bytes. Interactive applications, on the other hand, create smaller packets typically containing only a few keystrokes or screen data.

If you find that specific applications load the network down with many large frames, you can consider moving the relevant files, perhaps equipping a few individuals with different storage devices so that they can keep these files locally instead of pulling them through the network. Also, some hardware and software products allow you to control the maximum packet size and thereby vary network performance, loading, and single-station throughput.

NODE BY NODE While the screens and graphs described above allow you to test your network's overall performance, more-detailed screens let you concentrate on specific nodes on the network. By identifying the nodes that create or receive the most packets, you can reconfigure your network for optimum performance or change operating procedures to control the network load.

The HP 4972A allows you to build a list of up to 1,000 node names. New nodes are automatically added to the list and node name files saved to disk along with the data collected. You can also automatically add node names from a previously saved file, allowing you to find any missing names.

A number of different screens let you monitor nodes for specific characteristics. With the channel acquisition time screen, you can measure and chart the average time it takes to transmit a message on the network. This screen will show you how long it normally takes a node to gain access to the network.

Nicknamed the Star Wars screen by Hewlett-Packard users, the communication matrix is a patented HP display showing the level of activity among any 30 nodes. A larger or colored dot represents higher levels of activity. By moving the cursor around on the graph, you can identify the individual nodes that are communicating.

At this level of analysis, the management functions start resembling the analyzer functions in the number of variables you can select. You can use the filters de-

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PC Magazine
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finer for network analysis to characterize different types of packets. Each filter can be named and the filter criteria set to identify packets using different protocols. It is easy to add, name, and save new protocols with the testing files.

The analysis group distribution screen allows you to display a bar chart showing the frequency of different packet types (the types being derived from the defined filter formats). Captured packets are added to the counts of the filters that they match. This lets you easily see a summary of the types of packets flowing through the network or to a node.

With another screen, you can measure network response time for any node on the network. Using the filter format, you create a message packet. When the response time test is running, the message packet is sent to the node and the time needed to get a response is measured. This lets you see the effect of different protocol layers on response time, as well as determine the response time your users are experiencing.

Hewlett-Packard provides many tests that can run automatically. You can create a list of tests you want to run, including the desired duration of each test, and they will execute automatically. For any given test, you can set alarms to be audible, visual, or both. You can specify the minimum and maximum threshold, as well as the duration (in sampling periods) that will cause the alarm to sound.

These alarms go a long way toward enhancing the already powerful automatic scheduling of tests. You can instruct the system to branch to different tests, depending on the alarm conditions detected during tests. For example, you can program the system so that if the automatic network utilization test returns measurements in excess of 90 percent for more than five samples in a row, it will branch to the collisions test and capture data on the number and types of errors occurring.

In addition to its free 1-day seminars on communications protocols, Hewlett-Packard offers a 2-day \$1,000 training course for its HP-4972A. This feature-loaded analyzer is a serious network management and diagnostic tool you won't outgrow, and with the proper training, you should be able to identify and help correct any functional network problem.

NETWORK GENERAL CORP. Sniffer

The dual-mode Sniffer LAN analyzer, from Network General Corp., is already extremely popular among LAN troubleshooters and developers. While the original Sniffer worked only with Token-Ring networks, the new Sniffer 403 is unique among LAN analyzers in its support for both Ethernet and Token-Ring systems.

The dual-mode Sniffer we tested lists for \$24,000 plus \$995 for each suite of protocol interpreters. Protocol interpreter suites are available for Xerox Network Standard (XNS), Transmission Control Protocol and Internet Protocol (TCP/IP), International Standards Organization (ISO), and other common protocol systems used by companies like Novell, 3Com, and Excelan.

An upgrade package is available for existing single-mode Token-Ring Sniffers. The Sniffer comes with a 1-year warranty and 30 to 45 days of free phone support. Additional phone support is available for \$75 per hour. Network General also publishes a newsletter, *The Sniffer's Gazette*, which is available even to readers who don't own a Sniffer.

Although Network General is only 2

years old, its founder, Harry Saal, is one of the pioneers in LANs. He designed the Sniffer to let developers and troubleshooters inspect every possible trouble spot on the network and receive very precise, easy-to-understand feedback. The designers of the Sniffer paid particular attention to decoding the layers of communications protocols used in modern networks.

HARDWARE The Sniffer comes preinstalled in a Compaq Portable II. The specialized Ethernet interface includes a DIX (twisted-pair) connector, as well as a BNC (coaxial) connector, although in the standard configuration, only the DIX connector is operational. You connect the Sniffer to the network by means of a standard Ethernet transceiver cable and external transceiver.

The Sniffer capture buffer holds 256K bytes and has DMA (direct memory access) for rapid data transfer, but the usable buffer size shrinks if you have a large number of protocol interpreters installed. The capture buffer can be saved to disk for later study and analysis.

A capture trigger allows you to capture packets until the buffer is full. You also have the option of leaving some percentage of the pretrigger frames in the buffer, thus allowing you to examine events that occurred prior to the trigger event.

Capture filters allow you to screen out unwanted frames before they enter the capture buffer, while display filters let you see only certain frames from those captured. Frames collected in the capture buffer can be saved to disk files and replayed through the analyzer's filters and protocol interpreters but not back onto the network.

UNIQUE FEATURES The Sniffer's two strongest points are its user interface and its protocol interpreters. Eradicating bugs must be a number-one priority for Network General, since the software is virtually bug-free. The company's number-two priority seems to be product improvement and refinement.

The software presents a very slick user interface, with elements ranging from such window dressing as a moving logo to such truly useful features as the tachometer moving bar chart. It even has sound effects—clicks from the speaker that coin-

**EDITOR'S CHOICE**

FACT FILE

Sniffer
Network General Corp.
1945A Charleston Rd.
Mountain View, CA 94043
(408) 734-0464

List Price: 403 dual-mode version, \$24,000 (401 Token-Ring version, \$19,000; 402 Ethernet version, \$19,000); protocol interpreter suites for the IBM Token-Ring Network, Novell's NetWare, XNS-MSNET, TCP/IP, SUN Microsystems, ISO/MSNET, and Netstar, \$995 each; protocol interpreter for DECnet (Sniffer 402 and 403 only), \$1,995.

Requires: Token-Ring, Ethernet, ARCnet, or StarLAN network.

In Short: A full-featured and easy-to-use Ethernet and Token-Ring analyzer. Preinstalled in a Compaq Portable II, this analyzer is designed for use by LAN developers and troubleshooters. It uses an easy-to-follow visible tree menu structure.

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■ LAN ANALYZERS



Network General Corp.'s Sniffer system wins the Editor's Choice for its full-featured capabilities and easy-to-use menu system. It comes installed in a Compaq Portable II.



The Sniffer's Ethernet interface includes a DIX connector and a BNC connector.

cide with the incoming packets. Someone familiar with networks can become comfortable with the program in minutes without resorting to a manual. Nonetheless, the documentation is complete and contains several helpful examples.

You enter commands through a tree-structured menu that shows the commands available at the current and the next level. You move through the menu using the cursor keys and the Return key, toggling options on and off with the Spacebar. On-line help is always available through the F1 key. Pop-up windows help keep you oriented when calling up nested layers of help or other embedded screens.

An Ethernet cable-test feature is available from the main menu. This test determines how many nanoseconds it takes for a signal from the Sniffer to run into the problem and bounce back, giving an idea of the distance to the fault. (For example, 500 nanoseconds correlates to 390 feet of thick Ethernet cable or 320 feet of thin cable.) Since the test runs continuously, it is immediately obvious when cable integrity is restored. The Sniffer does not test To-

ken-Ring cables because they go to a hub that won't work without proper termination. Fortunately, cable testing is built into a Token-Ring system.

THE SNIFFER'S STRONG SUITS

The Sniffer's strongest feature is its capacity to decode even nested layers of communications protocols. Protocol suites are

available to translate each protocol layer into plain English with easily understandable prompts and some interpretation of the data values. The screen display shows data values in text, binary, decimal, or hex format and adds such interpretive comments as "Correct" or "OK".

The Sniffer allows you to view the function of only one protocol or all subsequent layers as well. You can easily choose between these options and display summary, detailed, or hex views of each packet. You can display one set of packets at a time or choose dual viewports to see different packets side by side. You can have as many as six data windows on the screen or zoom in to any one packet with a single keystroke to make the frame fill the entire screen.

The machine we used had 30 protocol interpreters—more than anyone but a developer would need. You can also write your own interpreters in C language for use with custom protocols or applications. Or you can have Network General design the interpreters your system requires for you for a fee.

■ **The Ethernet cable test** determines how many nanoseconds it takes for a signal to run into the problem and bounce back, giving an idea of the distance to the fault.



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■ LAN ANALYZERS

CONVENIENCES Like most other analyzers, the Sniffer will capture only to the RAM capture buffer. Although the capture buffer is only 256K bytes in size, three features of the Sniffer will let you increase the effectiveness of this buffer.

Careful use of capture filters will reduce the number of packets placed in the capture buffer. Defining trigger conditions can tell the Sniffer when to start or stop capturing packets. And a feature called partial frame capture allows you to capture as few as 128 bytes from every packet. Just as capture filters admit only certain interesting packets, the partial frame capture option lets you save only the interesting bytes in those packets.

Captured packets can be saved to or restored from files on the hard disk. Packets can also be replayed through new sets of triggers and filters, just as if the data were coming from the network again. Packets cannot be retransmitted on the network or edited from the capture buffer.

The Sniffer provides a convenient facility for managing symbolic names, or labels that you assign to some specific event or packet. Names stored in a file can be up to 31 characters long. New names are automatically flagged, and unknown names can be verified automatically by inspecting previous name files. Name files include the protocol level, allowing you to assign or substitute names based on the particular protocol a packet uses.

The Sniffer we reviewed did not have an operational traffic generator, but this feature will be included in the latest release of the product. The traffic generator will let you load the network at levels of up to 35 percent on Ethernet and 60 percent on Token-Ring systems. You will be able to adjust frame length and delay time between successive frames, put your own 16 bytes at the beginning of the frame, and address frames to any particular node on the network. This allows you to test the response time under various network loadings.

Capture filters are set in the Sniffer based upon several criteria. You can specify source or destination addresses, good packets or packets with certain types of errors, certain types of packets or protocols, and matches or mismatches of certain data patterns.

The Sniffer matches a data pattern based on up to 4 consecutive nibbles of data. (A nibble is half a byte, or 4 bits, and equals 1 hexadecimal digit.) You can specify the offset (number of bytes into the packet), as well as the data pattern you want to match. Each nibble is specified either as a digit (0 to 9 or A to F) or as a Don't Care (indicated by an x). This does not allow you to specify Don't Cares for individual bits but provides more accuracy than working at the byte level.

When displaying packets, you can see either absolute, relative, or interpacket time, or you can view the percentage of network utilization. Packets are time-stamped in 1/1000 second increments.

Network General has a demonstration disk based on the software used in the Sniffer. The demo allows you to examine several sets of sample data provided and introduces you to using the tool for diagnosing LAN problems. Demo disks are available in both Ethernet and Token-Ring versions.

For \$25, Network General also offers a 1-hour VHS videotape of Harry Saal conducting a Sniffer Token-Ring seminar on Stanford University's Video Learning channel.

Overall, the Sniffer is a very capable LAN analyzer. Designed for decoding multiple layers of communications protocols, the Sniffer is ideal for applications developers and system troubleshooters who deal with many different LANs. The Sniffer is not particularly strong in LAN management functions, but the continuous cable test and network utilization tachometer could be useful to network administrators. Its capacity to analyze Token-Ring as well as Ethernet networks makes it the logical choice for sites with both types of systems.

3COM CORP.

EtherProbe Network Utility

3Com Corp.'s *EtherProbe Network Utility* is a software-only, low-cost entry into the LAN analyzer market. As the name implies, it works only on Ethernet networks. It may not have the power of other network analyzers, but its \$995 price puts it in a league of its own.



FACT FILE

EtherProbe Network Utility

3Com Corp.
3165 Kifer Rd.
Santa Clara, CA 95052-8145
(800) NET-3COM
(408) 562-6400
List Price: \$995

Requires: 640K RAM, Ethernet network interface card (an EtherLink Plus card recommended), DOS 3.1 or later.

In Short: A software product that turns a 3Com EtherLink Plus network interface card into a low-cost IEEE 802.3 Ethernet LAN analyzer. Not copy protected.

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EtherProbe takes advantage of the 3Com EtherLink Plus network interface card. This card has an on-board 80186 processor and a 16-bit data bus and normally resides in servers on Ethernet-based networks. You can also use *EtherProbe* with 3Com's standard 3C501 workstation interface cards, but this would mean losing some of the speed and features of the system. *EtherProbe* will run on any IEEE 802.3 Ethernet network with 3Com adapter boards and drivers and DOS 3.1 or later. You could use it for elementary analysis of networks running Banyan Systems' *VINES* and Novell's *NetWare* operating systems, but it cannot interpret some of the protocols used by these programs.

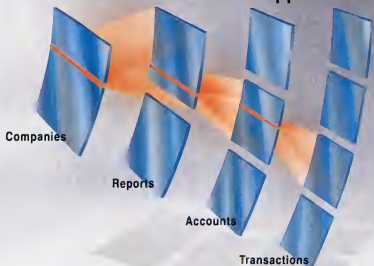
Installing this software is simple. The manual has a detailed three-page chapter on "Starting Up *EtherProbe*." All you have to do is make a boot disk and transfer the contents of the program disk to it, alter your CONFIG.SYS and AUTOEXEC.BAT files to match the ones shown in the manual, and select the right driver for the NIC you are using.

COMPETITIVE POWER

EtherProbe stands up well to its bigger and more expensive competition, partly because of the power already built into the 3Com EtherLink Plus card. *EtherProbe* has both manual and automatic capture triggering, and you can set capture filters to let you see only packets going to or from certain stations. This is usually necessary since the *EtherProbe* buffer can hold only 200 pack-

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■ LAN ANALYZERS

ets before it starts overwriting the oldest information.

The small buffer size is the biggest limitation of *EtherProbe*. However, by carefully timing sessions and using filters, you can minimize this limitation. You can also use an automatic trigger and limit collection to the maximum of 200 packets.

To help identify your data packets, you can specify names of up to 12 characters to replace the 12-digit Ethernet station address numbers. After entering these station names—along with the appropriate station categories (server, user, and so on)—in a convenient overlapping window, you can use them to facilitate sorting and analysis.

EtherProbe departs slightly from other analyzers in the format it uses to present system activity. From the main menu you can see a summary of data exchanges between different nodes, along with packet counts and directions. The most active exchange is highlighted on the screen. Packet transmission is represented by an ASCII smile-face character on the screen, with an arrow pointing in the direction the packet is traveling.

EtherProbe will also decode packet header information for several types of packets. This information is displayed in English or in decimal or hex fields with English prompts—much the way a database displays field names and values. The display decodes all known layers of protocol on the same screen. The data portion of each packet is displayed simultaneously in both hexadecimal and ASCII-character formats, unless you choose to display it in hex format only.

When using the *EtherProbe* software with an EtherLink Plus card, you can display packet arrival time either as an absolute time (in milliseconds) from a packet that you mark or as a relative time between packets. You can also display the percentage of the network being used at the time the packet arrived.

The *EtherProbe* package includes protocol interpreters for the packets commonly used on 3Com systems. These include the Xerox Network Standard (XNS) protocol stack (including IDP, SPP, PEP, RIP, Echo, and Error packets), the IEEE-standard Ethernet packets, and the 3Com extensions to Microsoft redirector Server Message Block packets. You cannot add



3Com Corp.'s *EtherProbe* Network Utility is a \$995 software-based LAN analyzer. It is designed to convert an EtherLink Plus network interface card into an inexpensive Ethernet LAN analyzer.

PC EDITOR'S CHOICE

• Sniffer

All the analyzers reviewed here are high-quality products. Choosing one over the others is basically a matter of selecting the combination of features that meets your particular needs at your particular price—\$19,000 is not unusual. (See The Connectivity Decision Guide.) With this Editor's Choice, we're putting our money where our mouth is. PC Labs is acquiring Network General Corp.'s Sniffer because we need the cable analyzer the Hewlett-Packard 4972A doesn't have and the protocol analysis alternatives not offered by the Ethernet Analyzer. 3Com Corp.'s EtherProbe Network Utility is also a strong contender, since it provides all the analysis capabilities most people will need at a price that's more affordable.

your own interpreters to *EtherProbe*.

The operational documentation for *EtherProbe* contains diagrams of typical screens and several appendixes of technical information. 3Com supplements the operating manual with a "Theory of Operations" manual, which describes the Ethernet architecture to help you understand what you see on the screen. As with most products, the best way to learn to use *EtherProbe* is to experiment with it. *EtherProbe* isn't just a troubleshooting tool—it's a great means for learning about the things that go on in your network.

The \$995 *EtherProbe* package can perform as well as a \$17,000 analyzer when it comes to finding a malfunctioning card or determining who is loading down the network. If you have patience and are willing to do some manual data recording, it will help you configure your LAN for optimum performance and uncover problems before the users complain. It won't help you find cable breaks, however. Buy *EtherProbe* only to learn how LANs operate and still get your money's worth.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine. Greg Campbell is an information systems manager with the Federal Government.

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1-2-3 BY ANY OTHER NAME

Spreadsheets are the lingua franca of business. 1-2-3 and its competitors have become essential in practically every profession. Few users, however, even begin to tap the full power of these programs. Many work only with templates designed by others and never need to learn how to write a formula or format a cell.

Until now these users had to have a copy of the full spreadsheet just to enter data into someone else's model. This is a waste of an expensive piece of software and can be a liability: inexperienced users may use spreadsheet commands mistakenly and wreck the model.

The two programs we review here, Brubaker Software's *The Baler* and Softlogic Solutions' *@Liberty*, turn spreadsheet models into standalone programs that can run without a copy of the original spreadsheet. *@Liberty* and *The Baler* can be used with any WKS, WK1, or WRK file. They use very different approaches, appeal to different markets, and sell for different prices. *The Baler* lists for \$495, *@Liberty*

for \$99.95. Another spreadsheet compiler, *LTS_2_C Software*, was slated to be released by Resource Analysis International (RAI) after this review. *LTS_2_C* will list for \$150 and will translate WK1 and WKS files into C-language source files.

These are not applications programs. They are tools that can save money and protect the integrity of the original models. Formulas in compiled spreadsheets can't be changed or even displayed, and there is no way to disclose hidden ranges. This means that people can enter data into your spreadsheet model and do calculations, but they can't tamper with the logic or read sensitive data.

It's no accident that few companies that make spreadsheet compilers also make spreadsheets. If managers and consultants started handing out self-running copies of their models, far fewer people would have to buy spreadsheets. One company even considered calling its compiler *One-Two-Free*, but was afraid some people might not enjoy the joke.

Spreadsheet compilers take the worry out of worksheet models by turning them into tamper-proof run-time files.

■ SPREADSHEET COMPILERS

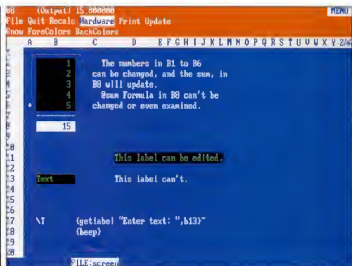
@Liberty

@Liberty is a good compiler for simple 1-2-3 and compatible templates. If your spreadsheets use only the functions found in Release 1A and you don't write complicated macros, @Liberty will turn your models into good standalone applications. Its recalc speed can be astonishingly slow, but everything else is quick.

@Liberty is easy to use, but you must make a few changes to your worksheets before you compile them. The most important is to unprotect every cell or range that you want the user to be able to change after the worksheet is compiled. These would generally be data entry cells or descriptive labels that the user might want to edit. Whatever you do, your formulas are safe. Users won't be able to edit or even examine them whether you unprotect them or not. @Liberty automatically builds in that protection.

The package comprises two different programs, PREPARE.EXE and RUN .EXE. You use PREPARE to process worksheet files into a special format that RUN can execute. It couldn't be easier: just type PREPARE and the name of the worksheet file. The process is automatic and there are no options or choices. PREPARE's output is a file that has the extension .SKW, which means it can be executed with RUN.

When the user executes a .SKW file



A compiled @Liberty spreadsheet uses an abbreviated 1-2-3 command menu. Unused columns are compressed to a two-character width. The macro in C17 will run, but new input strings can be no longer than the four characters in B13. The user can control screen colors.

with RUN, it comes up looking exactly like a spreadsheet. Yet most commands you would use to build a model won't work. You can't move, copy, set column widths, name ranges, or set windows, formats, titles, or protection. Essentially all you can do is enter data, do recalculations, run macros, display graphs, and print. Even data entry is limited in that you can't enter new labels that are longer than those in the original spreadsheet. Even if the column width is 20, if a cell has an unprotected two-character label in it, you can enter only two new characters into that cell. You can enter longer numbers—up to the maximum column width—but beyond that, you get a string of asterisks just as you would in 1-2-3. With 1-2-3, however, you can widen the column to fit the number. With @Liberty you're stuck with the asterisks.

SLOW RECALCS One of @Liberty's most surprising drawbacks is its recalc speed. In a performance test, it took 11 minutes to recalculate a spreadsheet that 1-2-3 calculates in 56 seconds. When I cut the spreadsheet exactly in half and recompiled it, @Liberty took 5½ minutes to cal-

■ @Liberty recalcs more quickly for some mathematical models than others; it may zip through certain kinds of formula or relationship while it chokes on others.

culate it, so this dismal performance was no aberration. A Softlogic representative said that @Liberty recalcs more quickly for some mathematical models than for others. In other words, it may zip through certain kinds of formula or relationship while it chokes lamentably on others. This, presumably, is why Softlogic claims that some of its compiled spreadsheets run more quickly than the 1-2-3 originals,



FACT FILE



@Liberty, Version 1.0
Softlogic Solutions Inc.
One Penimeter Rd.
Manchester, NH 03103
(800) 272-9900
(603) 644-5555
(603) 644-5556 (Electronic Bulletin Board)

List Price: \$99.95

Requires: 256K RAM, one disk drive, DOS 2.0 or later

In Short: An easy-to-use spreadsheet compiler that allows little control over the compiled product and limits distribution of models to 10 users (25 if an additional \$99.95 is paid). Good for simple models, but recalc is slow. Not copy protected.

Circle 69 on Reader Service Card



Spreadsheet Compilers: Summary of Features

(Products listed in ascending price order)

	@Liberty \$99.95	The Baler \$495.00
Maximum workspace (cells)	65,000	32,000
Offers formula protection	●	●
Can temporarily override formulas	○	●
Hides cells	●	●
Compiled spreadsheet can save changes	●	●
No. of displayable graphs	1	0
No. of graph types	3	0
Runs macros	●	●
Can hide spreadsheet borders	●	●
Has options in compilation process	○	●
Requires separate language compiler	○	●

— Indicates Editor's Choice ● — Yes ○ — No

though others obviously don't. I compiled a few other spreadsheets and found them all abysmally slow.

@Liberty's other big failing is that it doesn't support many Release 2 functions, but at least it checks for them while PREPARE compiles your spreadsheet. If it finds commands it can't handle, it displays their cell addresses in a status message on the screen so that you can go back and fix things.

Since the compiled worksheets can't do things like copy, move, or name ranges, even some very simple macros won't run. Because macros are nothing but strings of text to PREPARE, the program can't tell if you've included some that will confuse it. You have to test the compiled versions to be sure your macros work.

Still, many template users can live with these limits. Much of the processing power of 1-2-3, Release 1A, is yours at a small fraction of the cost. @Liberty can even do some things 1-2-3 can't, such as changing screen colors and adjusting screen update speed to eliminate snow. And if the original spreadsheet was prepared using some special @Liberty procedures, you can run the compiled version without screen borders and use six of the functions keys for starting macros.

Softlogic Solutions has a curious policy

regarding how you should distribute compiled spreadsheets. The compiled versions won't work without RUN.EXE, but the company asks that you give copies of RUN.EXE to no more than ten people. The @Liberty package actually comes with ten pamphlets that explain how to RUN an SKW file. You're supposed to pass them out one per customer, and buy a pack of 15 more for \$99.95 when you run out of them.

@Liberty seems to be the great beginning of a program that's not quite there. It is fine for simple spreadsheets, but until it recedes faster and supports more complex functions, it will not be the choice of the professional.

The Baler

The Baler does essentially the same thing as @Liberty but is designed for more technical users, people who want greater control over the compiled product. With The Baler you can choose whether to give the end user many ways to work with the model or only a few. Some effort is needed to get the program running, but you can tune the output to the user's needs. By contrast, @Liberty is a black box; you feed it a spreadsheet model and out pops an executable file. @Liberty does all the work for

you but gives you no choices at all.

The Baler can be tricky to set up. You can load all the program files into the same hard disk directory as the BASIC compiler, but things would get badly cluttered. If you want to establish different directories for compiler files, output files, Baler files, and so on, set your DOS environment and path properly. However, the pertinent instructions in the manual are not clear. Once The Baler is installed, anyone can run it, but you might have to make a tech support call to get it working. I did.

As with @Liberty, you have to prepare spreadsheets before you compile them. You must specifically unprotect all input cells and rewrite certain formulas. The Baler handles many more spreadsheet commands and Release 2 functions than @Liberty does, but it chokes on nested @ functions and conditional formulas that may evaluate to either a label or a value. In addition, you can't use macros that enter @ functions in input cells. You can rewrite your spreadsheet to get around most of these limitations, but fixing up a sophisticated application could be a great deal of work.

Once your spreadsheet is ready, you compile it in two steps. First you run The Baler itself. The Baler is not a compiler but a program generator that turns spreadsheet models into BASIC source code. If you're a BASIC whiz, you can customize this



FACT FILE



The Baler
Brushmaker Software
8825 N. County Line
Rd. E.
Lafayette, IN 47905
(800) 327-6108
(317) 564-2584

List Price: \$495 (in-

cludes Microsoft QuickBASIC compiler)
Requires: 512K RAM, hard disk drive and one floppy disk drive, DOS 2.0 or later.

In Short: A program that converts 1-2-3 spreadsheet files into BASIC source code that can be compiled into standalone applications. Difficult to set up, but it gives considerable control over the compiled output. Not copy protected.

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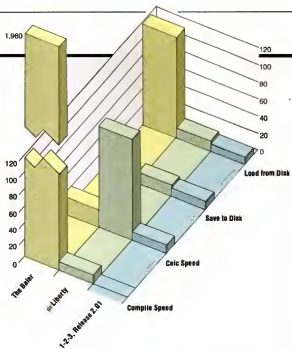
■ SPREADSHEET COMPILERS



Performance Tests: Spreadsheet Compilers

The compile speed of 46 seconds for @Liberty was close to 20 times faster than that for The Baler. The Baler, which is not actually a compiler but a program generator, turns the spreadsheet model into BASIC source code. Although this increases the time it takes The Baler to compile a spreadsheet, it results in much faster recalc speeds in the compiled worksheet. Nevertheless, the recalc speed of the worksheets compiled by both @Liberty and The Baler was considerably slower than that of the original 1-2-3 model.

Relative Times
(to Liberty = 100 in
Compile Speed results;
1-2-3, Release 2.01 = 100
for all other tests)



Performance Times (Times given in seconds)

	Compile Speed	Calc Speed	Save to Disk	Load from Disk	Disk Space	
					Compiled Spreadsheet (bytes)	Run-time Files (bytes)
The Baler	900	111	4	71	142,253	132,656
@Liberty	46	660	5	9	67,267	116,096
1-2-3, Release 2.01	N/A	56	4	6	80,652*	N/A

N/A—Not applicable: 1-2-3 is not a compiler and has no run-time files.
*Uncompiled spreadsheet.

Our spreadsheet compiler performance test fills the 2,000 cells between A1 and Z80 on a standard spreadsheet with labels and formulas that do both function math and square roots. The **Compile Speed** test measures how quickly the products compile the test spreadsheet. The **Calc Speed** test measures the time it takes to recalculate the compiled worksheet. The **Save to Disk** and **Load from Disk** tests measure the time required to write and read the compiled worksheet to and from disk. The **Compiled Spreadsheet** results show the RAM required to load the compiled spreadsheet. And the **Run-time Files** results show the RAM required to load the run-time files needed to use the compiled spreadsheet. All tests were conducted on an 8-MHz IBM PC AT with 640K bytes of RAM.

code before you compile and link it with the Microsoft QuickBASIC compiler.

ONE STEP, MANY STEPS You don't have to juggle code if you don't want to. If you wish, you can run the whole process in a single step without any user intervention at all. After *The Baler* generates source code, it writes a DOS batch file that runs QuickBASIC to compile and link automatically. You don't have to know BASIC in order to customize *The Baler's* output.

The Baler gives you many choices at the program generation stage, before it even writes the BASIC code. These choices, which appear as menu selections, let you decide which spreadsheet com-

■ *The Baler* is a program generator that turns spreadsheet models into BASIC source code.

mands to make available to users who run the compiled spreadsheet. For example, you can decide if you want the user to be able to format, name, copy, move, or protect cells. Likewise, you can decide

whether to enable such Data commands as Sort, Fill, Query, or Distribution, though for them to work you have to adjust your spreadsheet according to the documentation. @Liberty doesn't even give you any choice about these commands.

You wouldn't normally expect users of a compiled spreadsheet to name ranges or do Data Fills. The great advantage in including these commands is that your macros probably won't run without them. Moreover, there's little likelihood that the user will damage your spreadsheet with Moves and Copies because, as in @Liberty, the default status for all cells is complete protection. Formulas can't be changed, no matter what.

Command: Worksheet **Range** Copy Move File Print Quit
Format, Label, Erase, Input, Name, Just, Val, Trans, Prot, Unpr, Mod, Set



A spreadsheet compiled with The Baler shows formatting commands not available in 1-2-3. Unused columns and rows are not displayed. The macro in cell C17 will work normally. Screen colors are chosen by the compiler, not the user.

SPECIAL FORMULAS If you like, you can give the user of your compiled spreadsheets some formats he won't find in 1-2-3. Accounting format lets the user display a CR (credit) after negative numbers and a DR (debit) after positive numbers. Logical format displays a Y in cells with positive numbers and an N for negative numbers. You can even give labels left or right "gutter" format, which puts a specific number of spaces to the left or right of a range of labels.

You can also let the user improve on your work. If, at the code generation stage, you decide to permit formula "override," the user will be able to type in his own numeric values in place of calculated results. Downstream calculations will reflect that value rather than the results of the original formula. You can let the user override some or all formulas.

Finally, you can use a special "menuizing" feature in The Baler to build custom menus into your compiled spreadsheets that don't look anything like 1-2-3 menus. Used with autoexec macros, these can give your work the look of a fully customized

application program, but you may have to do some tinkering to get your designer menus to work.

With The Baler's wealth of features, it's surprising that the program doesn't support graphs at all. Another drawback is its speed. If your worksheet is of any size, The Baler compiles it slowly. This program took 15 minutes to compile a model that @Liberty compiled in 46 seconds.

SUMMARY Overall, The Baler is much more flexible and sophisticated than @Liberty, even if it's harder to use. More choices usually means more problems, and in this instance Brubaker Software has put more effort into features than into the user interface and the manual. The instructions and explanations seem a bit skimpy, but the company promises better documentation soon. If you need the power, can deal with the complexity, and can afford the price, The Baler should be your choice.

Jared Taylor is the West Coast editor of PC Magazine.

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CIRCLE 178 ON READER SERVICE CARD

PEN PUSHERS: PLOTTERS GO TO WORK

Plotter sales are on the rise, inching up even as sophisticated printers seem to be nibbling at the lower end of the market. Today, printers often deliver the kind of output that previously required small plotters. Dot matrix printers are coming on with more color, better resolution, and faster print times—all at low, affordable prices. Laser printers deliver quality reproduction of black-and-white images quickly and quietly. And if you want color, you can get it from thermal printers as long as you're not looking too closely for well-defined images.

It's no surprise, then, that the strength of the plotter market is in the larger units, the big hardware equipped to handle computer-aided design and drafting (CADD). Nevertheless, the desktop units, aimed primarily at business presentation graphics, are still finding customers. When we searched for plotters that had entered the market since we last took a look at them (see "Big Draws: The New Large-Format Plotters," *PC Magazine*, Volume 6, Number 11), we found two B-size units from Hitachi among the eight newcomers. In addition to the 672-XD and 673 models,

Hitachi has introduced a D-size plotter, the new 675.

The appeal of plotters is in the quality of their output. Printers simply cannot achieve the definitive lines and color intensity produced by good plotters. Printers deliver about 300 steps per inch at best, while a good plotter will achieve 1,000 steps per inch.

The *National Computer Retail Report* from IMS America, a research firm that audits actual product movement through the retail storefront channel, indicates that plotter sales revenues in the first half of 1987 were 30 percent higher than in the first 6 months of 1986. Unit sales rose only 19 percent, indicating that larger and higher-priced plotters were gaining over less

*As the demand for
high-quality output grows,
so grows the selection
of plotters. Here are eight
at home in any office.*

costly desktop units. Hewlett-Packard remains the market leader. According to the IMS report, the company held an 80 percent share of the retail dollar market in the first half of 1987. Its Hewlett-Packard Graphics Language is universally supported. Even Houston Instrument—which is a distant second in the market and employs its own proprietary language—will soon support HPGL.

DESIGN DECISIONS Significant factors in the design of a plotter are the sizes of media (paper sizes) they can accommodate and how the pens move across the medium to draw the image.

Some plotters can draw on a surface as small as a business card or as large as 3 feet by 4 feet. Plotters are designated as A, B, C, D, or E sizes under U.S. ANSI standards. An A-size medium is an 8½- by 11-inch sheet, while E size is 36 by 48 inches. There can be engineering and architectural variations on these sizes, but usually the distinctions aren't necessary. Plotters that can manipulate the larger media will cost you more. Physically they will be larger, and they must accurately control the pen

■ PLOTTERS

movement over larger distances.

There are three methods of moving the pen or pens over the surface of the medium. Each has its advantages and drawbacks.

Flatbed plotters, as the name implies, have a large flat area on which you fasten the medium by taping it down, using magnetic strips, or charging the surface so that static electricity holds down the medium. The pen head steadily moves along an arm, which, in turn, moves along one edge of the medium.

In drum plotters, the medium is wrapped around a circular drum and fastened at both ends. The drum rotates as the pen moves along a track.

Roller bed plotters are a variation on the drum theme (they are sometimes called drum plotters, although there isn't a

■ There are three methods of moving the pen or pens over the surface of the medium. Each has its advantages and drawbacks.

drum). The medium is grasped at two opposite edges by wheels and pinch rollers. The techniques used to assure a tight grip include grit particles on the wheels or deep scoring. The medium moves forward and back while the pen head moves along a track. As with the other designs, the result is access to every corner of the medium.

The roller bed method is the most popular. It's straightforward and most easily maintains accuracy. All of the plotters reviewed here use roller bed designs.

Plotters that can handle only one pen are less costly than those that will manage several. Single-pen plotters may be adequate for many situations. Most graphics software can be instructed to pause and let you change pens by hand if you require different colors or tip widths.

Still, automatic pen changing is a high-

ly desirable feature. Pen-changing mechanisms fall into two broad classes. The first stores the pens at one side of the plotter, usually in a rotating carousel or a row of stationary stalls. The pen head holds a single pen and retrieves the other pens as needed from the carousel or stall. The second type positions the pens in the pen head itself, so that all of them travel along as it traverses the medium. This is theoretically faster, since the pen head doesn't have to move to the edge of the plotter to store and retrieve pens.

Either method works well. Perhaps a more important consideration is whether the pens are capped as they are waiting to be used. If not, they can dry out.

MANY MEDIA The word *media* is more than jargon or pedantry, since various materials can be used for plotting. Paper is certainly the most common. You can use common copier bond paper, although it isn't particularly good idea. Most copier papers have a rather rough surface that can wear down pens, resulting in diminished line quality. Special, smoother plotter papers are available from several plotter manufacturers and third-party vendors. Coated bond stocks, with either flat or glossy finishes, are even better.

Vellum is definitely the paper of choice for serious CAD work. It's specially coated for the maximum smoothness possible and chemically treated to promote strength and transparency.

Several types of film can also be used. Transparency film is clear and is usually used for overhead projection. The slick surface doesn't absorb ink as paper does, so you'll need special inks and slow plot speeds to draw an image that will adhere without smearing.

All papers expand and contract as temperature and humidity change, and they will degrade over time. Paper instability and aging are often irrelevant, but for critical applications, or where archival permanence is a factor, a special matte-finished polyester film is recommended for stability and longevity. This film is costly and requires special pen tips.

PENS AND INKS Fiber-tip pens wear down, but they provide bright colors and can plot at moderately fast speeds on bond



Plotters: Summary of Features

EXPLANATION OF FEATURES Plotters are categorized according to the **maximum paper size** they can accommodate. Size A is 8 1/2 by 11 inches, B is 11 by 17, C is 17 by 22, D is 24 by 36, and E is 36 by 48. Paper movement distinguishes between **flatbeds**, in which the pens move over stationary paper, and **roller beds**, usually found in large plotters in which the medium rolls beneath the pens as they draw. Plotters use various types of **paper hold systems**, including electrostatic, magnetic, grit wheel (which holds the medium in place with friction), and pinch roller (which requires special media with printerlike guide holes on the edges). **Number of pens** is self-explanatory. **Pens auto-capped** refers to automatic pen-capping capability, which is necessary to prevent drying of the pen tips. **Maximum pen speed** is the fastest speed claimed (rates can vary depending on whether the pen is moving diagonally or along the x or y axis). Almost all plotters allow for **adjustable pen speed**, but while some let you specify any speed within their range, others can adjust the speed only in fixed increments, which are sometimes set by switches rather than by software. **Step size and accuracy** are the major determinants of a plotter's ability to create sharp and detailed plots. **Step size** is measured either in the number of steps per inch or by distance measurement. Theoretically, the more steps per inch, the better the resolution. The measure of accuracy here is the percentage of accuracy over a long pen move. **Buffer size** shows the amount of RAM built into the plotter itself for storing instructions. Some of the plotters tested let you add RAM to expand the buffer size. **Optimization** indicates whether the plotter includes a system to decrease the length of time a plot requires. Some plotters allow digitizing by letting you move the pen head to a desired position with cursor keys, then send its position coordinates to the computer by hitting a key on the operator panel; hence the **act as digitizer entry**. **Auto paper feed** indicates capability for producing a sequence of plots without manual intervention by using a batch process (the graphics software in use must also allow this; most business graphics and CAD programs currently do not).

The **interface** section shows what type of interfaces are available or standard. Most personal computers use either serial RS-232 or parallel Centronics interfaces. The IEEE interface, also known as GPIB (General-Purpose Interface Bus) or HP-IB (Hewlett-Packard Interface Bus), is designed primarily for scientific and control applications.

The **programming** section lists graphics command languages. HPGL, the Hewlett-Packard Graphics Language, is emerging as a de facto standard. **Proprietary** indicates a manufacturer's own command set. **Other** indicates that manufacturer chose to emulate a graphics language other than HPGL. **Bundled** software indicates whether any commercial graphics software is included with the plotter.

PHYSICAL SPECIFICATIONS

	Hitachi 672-XD \$895	Hitachi 673 \$1,695	Ester Computer SP1000 \$3,995	Houston Instrument DMP-61 \$4,695	Hitachi 675 \$5,695	Meloh IP-500A \$5,900	Western Graphtec PD8111 \$5,995	DCI 920 \$8,900
Max. paper size	B	B	D	D	D	D	D	E
Paper movement	Roller bed	Roller bed	Roller bed	Roller bed	Roller bed	Roller bed	Roller bed	Roller bed
Paper hold system	Pinch roller	Pinch roller	Pinch roller	Pinch roller	Pinch roller	Pinch roller	Pinch roller	Pinch roller
No. of pens	4	4	1	1 (6 optional)	8	8	4	8
Pens auto-capped	○	○	○	●	●	●	●	●
Max. pen speed (inches per sec.)	7.9	15.7	24	32	19.7	19.7	15.7	24
Adjustable pen speed	●	●	●	●	●	●	●	●
Step size	.05 mm.	.025 mm.	.001 in.	.001 in.	.025 mm.	.001 in.	.025 mm.	.0098 in.
Accuracy (percent)	.4	.3	.2	.2	.2	.1	.35	.1
Buffer size	512K	4K (128K optional)	18K	16K (1 Mbyte optional)	18K	30K	6.6K (256K optional)	7K
Optimization	○	○	○	○	○	○	○	○
Acts as digitizer	●	●	●	●	●	●	●	●
Auto paper feed	○	Optional	○	○	○	○	○	○
Weight (lbs.)	13.2	14.3	100	55	103	132	106	140

INTERFACE

Serial	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Parallel	Standard	Standard	None	None	Standard	None	Optional	None
IEEE	None	None	None	None	None	None	Optional	Standard

PROGRAMMING

HPGL	●	●	●	○	●	●	●	●
Proprietary	○	○	○	●	○	○	●	○
Other	○	○	○	○	○	○	○	○
Bundled software	○	○	○	●	○	○	○	○

—Indicates Editor's Choice ●—Yes ○—No

■ PLOTTERS

stocks. Fiber pens for paper use a water-based ink, while those designed for transparency film use an oil-based ink. Ballpoints can plot at high speed, especially if the ink is pressurized within the pen to assure ink flow, and they produce very even lines, though without the vividness of fiber pens.

The ultimate plotter pens use liquid ink. These are available with reservoirs, which you fill from a bottle of ink with a syringe. This produces an elegant image but is messy, and the ink tends to dry out rather quickly. Liquid-ink pens can be used with pen tips, including special metal tips (usually tungsten) for abrasive films. Disposable liquid-ink pens, preloaded with liquid ink, are also available. You discard them when the ink runs out. Both types of liquid-ink pen must plot at much slower speeds than some of the other types to produce a consistent image that does not smear.

Different pen types also require different degrees of pressure against the medium, and sometimes different accelerations and pen up/down speeds. Many of the more sophisticated plotters sense the type of pens in use—by detecting markings either on the pens themselves or on the pen-holding mechanism—and adjust automatically. Other plotters allow you to make the adjustments with switches or settings on the front panel.

ENTER COMPUTER INC.

Enter Computer SP1000

Hardware and software costs were high when CADD first became available on microcomputers. With D- and E-size plotters representing a major portion of total system cost, several plotter manufacturers introduced simple, low-cost, single-pen plotters for the new micro market.

Enter Computer's SP1000, which lists for \$3,995, has a single-pen design. With this type of plotter, you can instruct most graphics software to pause and let you change the pen manually, but many users manage with only a single pen. The SP1000's pen holder accepts any Hewlett-Packard-style pen, including fiber-tip, roller-ball, liquid-ink, drafting, and ceramic pens.



Enter Computer's SP1000 (above) is a D-size single-pen model. The operator panel (left) features a backlit LCD with two rows of 24 characters, which are quite legible even at a distance.

The SP1000 is a floor-standing D-size plotter of conventional pinch roller and vacuum hold-down design. One of the rollers is movable, and the grit wheel the rollers contact extends the full length of the plot area, so the SP1000 can accommodate any size medium up to D. Some plotters can manage only discrete media sizes, and the SP1000 is slightly more flexible than these.

Medium hold-down is activated electronically via a panel control. The SP1000 has no automatic size sensing for media; you must select the medium size with the operator panel. Unlike many plotters, the SP1000 does not allow the software to override this setting, so you must be sure to select the size correctly.

The operator panel features a backlit

LCD with two rows of 24 characters—8 more characters than on most such displays. The backlighting is very bright, and the SP1000's blue characters are quite leg-



FACT FILE

Enter Computer SP1000

Enter Computer Inc.
6867 Nancy Ridge Dr.
San Diego, CA 92121
(619) 450-0601

List Price: \$3,995

In Short: Enter's best plotter to date. Advanced features and excellent plot quality on a D-size plotter for a reasonable price.

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ible, even from a distance. Four function keys immediately below the display are used to adjust the plotter's operating parameters via a tree-structured menu system. You can store your preferences in nonvolatile memory, so you don't have to adjust the settings each time you use the plotter. The panel also has 19 buttons, including a numeric pad. But the numeric keys are not used at all in the plotter we tested, being "reserved for future product enhancements."

The SP1000 provides a standard RS-232 serial interface, which you can configure from the panel. It emulates HPGL, the language of HP's 7580 plotter.

SLOW SPEEDS Our tests of the SP1000 were uneventful. Enter provided only disposable liquid-ink pens, so we used these for our sample plots. Configuration menus were intuitive and easy to use. Enter did not provide any serial cable, but by using a SmartCable as a replacement we had no trouble interfacing to our test system and AutoCAD.

Plot times were slower than we expected, given the SP1000's pen-speed rating. Remember, though, that we were using

■ The SP1000's plot quality was superb, with solid diagonals and excellent accuracy. The images were exceptional.

liquid-ink pens, which must be run at slower speeds than fiber-tip or roller-ball pens.

Plot quality was superb, with solid diagonals and excellent accuracy. Liquid-ink pens usually provide fine plots, but the SP1000's images were exceptional.

The SP1000 is a quality plotter—the finest plotter ever offered by Enter, in our opinion. The very readable backlit display, the menu structure, the nonvolatile memory, and other advanced features are strengths that balance the limitations of the

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■ PLOTTERS

single-pen design. At \$3,995, this unit should appeal to CADD users who need immaculate D-size drawings at minimal cost.

HITACHI AMERICA LTD.

Hitachi 672-XD

Hitachi America, a respected Japanese electronics manufacturer, has introduced a line of pen plotters, of which the \$895 672-XD is the least expensive. The Hitachi 672-XD is a B-size, roller bed device using friction roller pinch wheels to grab and move the medium forward and backward. A four-pen rack forms the pen head, so all the pens travel as the plot is drawn. They are not capped in the rack, so they are likely to dry out if left for extended periods.

The 672-XD emulates the HPGL graphics language—specifically, it emulates the Hewlett-Packard 7475—so many graphics software programs will run with no problem.

Both parallel and serial interfaces are included. Two DIP switches, with a total of 12 positions, configure the interface. The 672-XD can use either fiber-tip or ceramic pens. This selection is limited compared with what other plotters offer, even in this low-price category.

The operator panel consists of only two LED indicators and six buttons, each with two settings. A few special multiple-button sequences are available, too, but more options would be appreciated.

The 672-XD's case is a rather flimsy plastic. The panel buttons are none too

sturdy and the muted beige and brown colors give an overall feel to the unit that is less than impressive.

Our tests showed the 672-XD to be slow. The potential speed advantage of the moving-pen mechanism is negated by the pen-changing design. It appears the moving-head design was chosen over a rotating carousel more for mechanical simplicity than for speed. The pen head must travel to either edge of the plotter to move the actuating element that forces the pens up and down. This extra movement wastes time. It

took nearly three times as long to draw the four-color shuttle than for the one-color.

Diagonal lines showed no obvious wavering. But the halves of the nozzle image did not line up particularly well, which indicates some inaccuracy either in the pen head control motors or the paper movement mechanism.

The 672-XD's saving grace is its low price, well below that of most B-size plotters. If you don't need the plotter for heavy use and can accept its trade-offs, the 672-XD may meet your needs.



The Hitachi 672-XD (above) is a B-size roller bed model with a four-pen rack that forms the pen head. The operator panel (left) consists of two LED indicators and six buttons, each with two settings.



FACT FILE

Hitachi 672-XD
Hitachi America Ltd.
6 Pearl Ct.
Allendale, NJ 07401
(201) 825-8000
(415) 872-1902 (San Bruno, Calif.)
(416) 826-4100 (Canada)
List Price: \$895

In Short: An inexpensive B-size plotter with only fair speed, construction, and plot quality. Attractive only if price is the prime consideration.

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■ PLOTTERS

HITACHI AMERICA LTD.

Hitachi 673

The second entry in Hitachi America's new line is an upgraded version of the B-size 672-XD for which Hitachi claims both higher speed and accuracy.

Like the 672-XD, the Hitachi 673 has a roller bed design that holds the medium with two pinch rollers. The operator panel has a membrane design. Four LED indicators show plotter status. Six buttons each perform three functions for a total of 18 settings, but your options are obviously more limited than with more-flexible panels. One useful setting lets the plotter accept ASCII-character input and function as a slow printer.

The Hitachi 673 uses the same pens as the larger Hitachi 675. Ceramic pens are standard but roller-ball, fiber-tip, and both disposable and refillable liquid-ink pens are available.

HPGL emulation is standard. Although the manual doesn't mention which Hewlett-Packard model is emulated, it proved to be HP's 7475.

The 673 has standard serial RS-232 and parallel interfaces. You configure the plotter with two switches that offer 12 positions between them. We had no trouble using the serial interface with AutoCAD.

Hitachi offers an optional 128K-byte buffer, which can be used in two modes. Both modes accept data as fast as the computer can send it. In one mode the data is flushed at the conclusion of the plot, so the buffer is ready to accept the next plot. The other mode retains the data, so you can

produce multiple copies of the plot without retransmitting the data from the computer.

An optional automatic paper loader can store and feed up to 50 sheets of A- or B-size medium. You can feed sheets manually or via software commands. If you have the buffer, you can program the auto-feeder to produce multiple copies.

Our test plotter evidently was equipped with the "large buffer" option, since the plotter accepted plot instructions as fast as our test AT could send them. Control of the computer was returned immediately af-

ter all the instructions had been sent. In the case of our test nozzle plot, the 673 accepted the data in only 1 or 2 minutes and continued to plot for 6 or 7 minutes on its own.

Plot speed on the PC Labs tests was two to two and a half times faster than the Hitachi 672. The plots produced by the 673 were good but not perfect. There was some slight mismatching between the halves of the nozzle, and the accuracy was less than exact. We also noted slight wavering in diagonal lines; this is usually a sign that the plotter is being run at or near the limits of



The Hitachi 673 (above) is a B-size roller bed model. It uses ceramic pens, but others are available. The operator panel (left) has four LED indicators and six buttons: each button performs three functions for a total of 18 settings.



FACT FILE

Hitachi 673

Hitachi America Ltd.
6 Pearl Ct.
Allendale, NJ 07401
(201) 825-8000
(415) 872-1902 (San Bruno, Calif.)
(416) 826-4100 (Canada)
List Price: \$1,695

In Short: An acceptable B-size plotter with moderate performance, though others in the category offer more value at equivalent prices.

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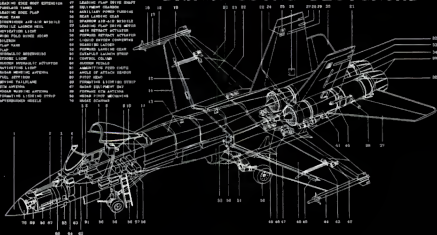
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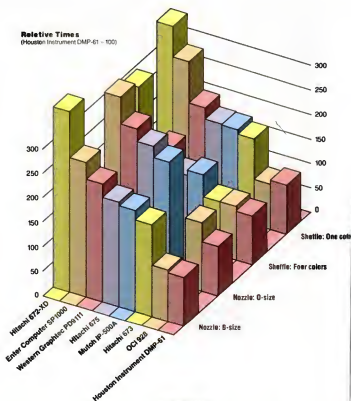


■ PLOTTERS



Benchmark Tests: Plotters

The Houston Instrument DMP-61 and OCI 928 turned in impressive times on the PC Labs Plotter Speed benchmark test. Both performed about twice as fast as the three slowest plotters, the Hitachi 672-XD, the Enter Computer SP1000, and the Western Graphictec PD9111. Speed is a function of efficient pen handling and design and can be affected by the types of pen heads and media used. Liquid-ink pens typically post the slowest times as they allow for the ink to dry. Plotters in this comparison were tested with the pens and media supplied by the manufacturer. The Enter Computer SP1000 uses liquid ink, which could account for its slower times. However, the Houston Instrument DMP-61, one of the fastest plotters in this test, also uses liquid ink. The Western Graphictec PD9111, Mutoh IP-500A, and OCI 928 used fiber-tip pens, while the Hitachi plotters all used ceramic tips.



Performance Times (Times given in minutes)

	Nozzle: B-size	Nozzle: O-size	Shuttle: Four colors	Shuttle: One color
Hitachi 672-XD	16.8	N/A*	18.8	8.9
Enter Computer SP1000	12.5	19.9	N/A*	7.4
Western Graphictec PD9111	10.9	16.7	10.8	5.3
Hitachi 675	9.7	15.2	8.2	4.7
Mutoh IP-500A	9.4	13.9	8.9	4.6
Hitachi 673	8.5	N/A*	6.3	4.4
OCI 928	4.6	7.9	6.3	2.3
Houston Instrument DMP-61	4.8	5.6	5.7	2.5

The **Plotter Speed** benchmark test assesses the time required to draw a nozzle image in B and O output sizes, and a space shuttle image in one and four colors in the B-size format. The test is conducted using an 8-MHz IBM PC AT with 640K bytes and an 80287 math coprocessor. Auto-

desk's AutoCAD, Version 2.5, is used to generate the images. Results show the time in minutes the plotter takes to complete the images. AutoCAD's plotter optimization feature is disabled. The plotters are tested at their highest operating speed, using parallel interfaces where possible.

N/A*—Not applicable: Hitachi models 672-XD and 673 do not produce D-size plotter output.

N/A*—Not applicable: The Enter Computer SP 1000 is a single-pen plotter and was unable to perform the multipen test.

	Nozzle: B-size	Nozzle: D-size	Shuttle: One color	Shuttle: Four colors
Enter Computer SP1000				
Hitachi 672-KD		Does not produce D-size output		
Hitachi 673		Does not produce D-size output		
Hitachi 675				
Houston Instrument DMP-61				
Mutoh IP-500A				
OCI 928				
Western Graphitac PD9111				



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To date, none of the above offers a LAN version. And even if one did, consider this: *PC Week* called Enable 2.0, "Best integrated software package on the market." *PC Magazine* wrote, "Enable is everything Symphony hoped to be." And once you plug into Enable's ease, speed and impressive capabilities, you'll agree with *Personal Computing* that, of all integrated software, "this is the one program to seriously consider." Enable has it now. One cost-effective package to buy, train on and one (very responsive) vendor to deal with. We're the one package that's totally able to meet your needs.

For more information and nearest Enable dealer, dial 1-800-634-3470. New York: 1-800-551-1004. Canada: 1-800-267-9967. Ask for Dept. M. © 1987 The Software Group, Dept. M, Northway Ten Executive Park, Ballston Lake, N.Y. 12019

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■ PLOTTERS

its mechanical design capabilities.

The 673 is an acceptable device, but there are some excellent competitors in its price bracket.

HITACHI AMERICA LTD.

Hitachi 675

The Hitachi 675, an unusually compact D-size plotter, is the flagship of Hitachi America's new plotter line. The front-to-back dimension is several inches shorter than on similar plotters; this may permit the use of the 675 in areas where a larger device wouldn't fit. The compact size is not an indication of fragility, however. At more than 100 pounds, the 675 is hardly a lightweight.

The medium is held down with vacuum and pinch rollers. One roller is movable and accommodates A- through D-size media. The hold-down is activated with a mechanical lever. Once you've clamped the medium, the 675 scans it and determines its exact size, displaying the conclusion on a row of eight LEDs (four sizes for ANSI media and four for ISO sizes) on the operator panel.

The panel also includes 11 membrane keys, several of which do multiple duty and sport LED indicators. The panel is better and more flexible than those on the less costly Hitachi plotters reviewed here, but it is not up to the competition in this price range. We miss having an LCD alphanumeric readout.

The 675 is configured with three DIP switches, with a total of 20 switch posi-

tions. The switches are recessed deep in the plotter's base, and they have tiny moving elements that are difficult to read even close up. We could barely see how the switches were set, and went through several false starts before configuring the plotter correctly. A paddle design switch would help the situation.

The 675 stores up to eight pens in its moving pen rack. The pens aren't capped, but when a plot is complete the 675 moves the pen head into a sheltered area to prevent drying. Available pen types include ceramic, liquid-ink, and both aqueous and pressurized ball points, but not fiber-tip pens.



The Hitachi 675 (above) is a compact D-size model with a moving pen rack that stores up to eight pens. The operator panel (left) has a row of eight LEDs and 11 membrane keys.



FACT FILE

Hitachi 675

Hitachi America Ltd.
6 Pearl Ct.
Allendale, NJ 07401
(201) 825-8000
(415) 872-1902 (San Bruno, Calif.)
(416) 826-4100 (Canada)
List Price: \$5,695

In Short: A compact D-size multipen plotter with good but not exceptional performance. Some paper-handling problems. Competent but unexciting.

CIRCLE 888 ON READER SERVICE CARD

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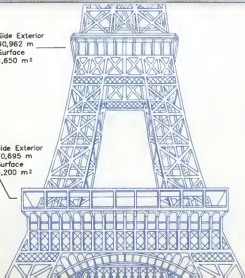
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■ PLOTTERS

There are a few interesting options built into the 675. Like its smaller Hitachi stablemates, you can use the plotter as a slow and expensive printer to plot ASCII characters. This might be useful in debugging plotter programs you write yourself. The 675's character ROMs include several dozen electrical symbols, much like those included in CAD symbol libraries. These are accessible only if you write your own software.

HANDY OPTION The most interesting option is an external buffer memory box called the 675-5050. Instead of the usual RAM buffer, this device uses a double-sided, double-density 3½-inch microfloppy disk as its storage medium. The floppy's 800K-byte capacity is generous, but reasonably inexpensive RAM buffers are available with 512K bytes or 1 megabyte of memory. The big advantage of the 675-5050 is that in a multiple-workstation environment, suitably equipped users could write drawing files to a microfloppy disk for off-line plotting on the 675 plotter.

The buffer can operate in four modes. It can receive data from the computer and store it on disk without plotting; plot from the disk; store while plotting; and pass data through from the computer without storing it to disk. But the bidirectional nature of HPGL restricts the operating modes to "pass through" or "store and plot" modes.

The buffer's front panel uses membrane switches to select the operating mode and control buffer storage. Several LEDs clearly indicate operating status. The buffer is designed to hold up to four plot files within its 800K-byte capacity, and panel buttons let you plot any of the four files. The buffer can be mounted to the 675 plotter with a supplied bracket, or it can sit adjacent to the plotter on any convenient surface.

Our first experience with the 675 was less than positive: we always run a plotter's internal self-test before connecting it to our test system. The 675 jammed and tore and crumpled our two test plots. The automatic media-size-sensing system brings the medium very close to its rear edge, and fast movement to the edge evidently can cause the medium to slip out of the roller on one side. We didn't have any

trouble with our standard test plots, though, even though the medium again came perilously close to the edge.

The self-test drew an orthogonal grid at speeds from 100 to 500 millimeters per second in 100-mm increments. We could see a loss in accuracy as the speed increased, although the differences were not terribly significant. The distinctions probably would have been greater if diagonal lines were being drawn.

Indeed, we did see some slight wavering on diagonal lines in our benchmark test plots. Overall quality was good but not exceptional. Plot times were moderate. The 675 uses a pen-changing mechanism similar to its smaller Hitachi cousins. While the pens travel with the pen head, the head must move to either side so the small actuating lever that actually presses the pens down onto the medium can change position. Since the plot bed of a D-size plotter like the 675 is larger, this process takes longer than it does with the smaller plotters.

The Hitachi 675 is strictly middle-of-the-pack. It's neither the fastest nor the slowest we've seen, and the plots it generates are neither the best nor the worst. Its price is not out of line, nor particularly enticing. The compact styling, though, might make it an attractive option for cramped quarters.

HOUSTON INSTRUMENT

Houston Instrument DMP-61

Houston Instrument plotters are known for offering fine performance at attractive prices. The \$4,695 Houston Instrument DMP-61 is the first member of a totally new line of plotters.

The DMP-61 has a roller bed design, using pinch roller and vacuum hold-down to secure the medium. One of the pinch rollers can be moved to accommodate media from A through D size. The movable roller has a set screw, which you insert into holes sized for specific media. Each time, the plotter senses which hole you've used and knows the width of the medium.

Each roller has a lever to raise and lower it and to hold the medium in place. This system (which HI has used for many years)

works well, although it's less sophisticated than the electronic or even single-lever systems found on other plotters. Once the medium is in place, the DMP-61 scans and senses the depth of the medium, a feature that isn't found on other plotters. On the other hand, there are no provisions for medium deskewing or for alignment to pre-printed or gridded media.

Houston Instrument offers an optional 1-megabyte RAM buffer. It can be programmed to retain incoming data for multiple replots without retransmission of the plotting instructions.

The operator panel consists of 12 keys and 4 LED indicators. The LEDs are used to indicate a variety of operating modes and error conditions. Only the normal functions of the LEDs are printed on the panel, so you must refer to the documentation to decipher what the combinations of various steady and flashing LEDs mean when an error occurs. While HI gets a lot out of only four lights, there's no question that an alphanumeric LCD readout is more informative and easier to use.

Instead of an LCD readout, the DMP-61 includes HI's excellent hard-copy menu system. When you invoke the menu system, the plotter actually plots English prompts to solicit your configuration decisions. You use the pen movement arrows to position the pen head over the option you want. You can adjust 21 operating parameters, including such factors as pen acceleration, communications parameters, whether to perform pen-changing commands, what kind of zero character you want, and more. You can also plot the current settings and change only one variable—without plotting all the settings. Your choices are saved in nonvolatile RAM for future use.

You can control the plotter's parameters directly from your computer, using a menu program supplied with the plotter. The program is colorful and easy to use.

The DMP-61 is basically a single-pen device. If you need multiple pens, HI's MP-6 option (\$750) stores six pens in self-capping stalls. The available pens include disposable and refillable liquid-ink, fiber-tip, and hard-nib plastic-tip types.

The DMP-61 employs an enhanced version of Houston Instrument's traditional DMPL graphics language. The primary

Ah, the big idea. Everyone has one. But not everyone can afford a plotter to plot one on. Which got us thinking. What if there was an HP quality plotter so reasonably priced you could afford to hook one up to every PC CAD workstation in the office?

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The drawing shown below was produced on the HP DraftPro with VersaCAD software.

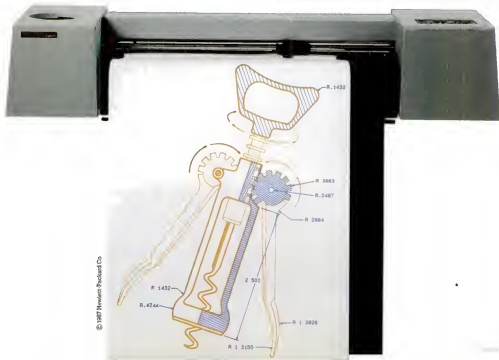


**HEWLETT
PACKARD**

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CIRCLE 339 ON READER SERVICE CARD

How to pull off a fantastic HP plot for only \$4900.



■ PLOTTERS

improvements are the new commands to generate 15 hatching patterns internally for both closed areas or text fonts; this procedure is faster and may produce better output than software-generated hatching. Software vendors would have to change their drivers to take advantage of the new DMPL commands, but since the new

DMPL is downward-compatible with earlier versions, there is no real need for them to do so.

ADDING HPGL Houston Instrument reports that it will be adding HPGL compatibility to its entire line in 1988. This is an important development and will increase

the utility of the HI plotters tremendously. While most major packages support DMPL, many secondary programs do not. Users will benefit.

The DMP-61 also includes improvements to the internal ROMs, which now generate continuous curves rather than producing curves by drawing small, straight line segments at offset angles. This is faster and generates better-looking curves. The system works with existing DMPL software; there is no need for any program to change its driving instructions.

The setup menu is convenient and easy to use, and AutoCAD happily plots to DMPL devices.

In our tests, the DMP-61 performed *much* faster than any previous HI plotter. It is significantly faster than plotters in its price class, and actually competes with such E-size speed demons as the Hewlett-Packard DraftMaster and even the super-quick \$7,950 Bruning Zetadraf 900 (see *PC Magazine* "Big Draws: The New Large-Format Plotters," Volume 6 Number 11). The pen changer is somewhat slow.

This performance is not achieved at the expense of the plots. Line quality is excellent, with solid diagonal lines and superb matching of nozzle halves. The only problem we experienced was with the pen changing. A loose screw, literally, caused a lack of synchronization when pens were changed. In other words, the plotter thought it was in one place, and the driving software thought it was in another. Houston Instrument corrected the problem, and now we doubt that any other plotter on the



Houston Instrument's DMP-61 (above) is a D-size single-pen model; however, a six-pen device is available. The operating panel (left) consists of 12 keys and four LED indicators.

PC FACT FILE

Houston Instrument DMP-61

Houston Instrument
8500 Cameron Rd.
Austin, TX 787
(800) 444-3425
(512) 835-0900

List Price: \$4,695; six-pen option, \$750.

In Short: Another winner from Houston Instrument. The first in a new generation of HI plotters, the D-size DMP-61 is fast, accurate, and competitively priced, and it produces beautiful output.

CIRCLE 604 ON READER SERVICE CARD

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The HP ColorPro Plotter is as easy to use as a printer. At only \$1,295*, it

may be just where you want to start. But if your needs are more sophisticated—say, for larger charts or higher plotting speeds—you may prefer one of the other models in the family. Whichever you choose, you're assured of overheads with startling color and precise lines. And you know you can rely on the design and engineering excellence of Hewlett-Packard, the company whose name is synonymous with laser printers and plotters.

For a colorful sample overhead, and the name of your nearest dealer, call 1 800 367-4772, Ext. 903A.

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Guess which presentation made the sale.



■ PLOTTERS

market today can match the performance of this one.

Houston Instrument produces a fine line of plotters, but the DMP-61 is the best to date. It's fast, accurate, and produces first-rate output with a minimum of fuss. The operator panel could be more flexible, but apart from the synchronization problem when pens are changed, there's very little to criticize. Its price-to-performance ratio is excellent. Competing against Hewlett-Packard isn't easy, but the DMP-61 puts a powerful new arrow in Houston Instrument's quiver.

MUTOH AMERICA INC.

Mutoh IP-500A

Mutoh America bills the IP-500A as a "personal plotter," an odd moniker for something that weighs over 130 pounds, but this label distinguishes the Mutoh IP-500A from Mutoh's costlier plotters. Even at a list price of \$5,900, the IP-500A seems eminently professional.

The IP-500A has an eight-position rotating pen carousel that self-caps to minimize ink drying. It handles pencils in addition to the common ink, oil- and water-base fiber, water-base ballpoint, and ceramic pens. Pens and pencils can be mixed in the carousel, eliminating the need for multiple holders for different types of implements. Pencils are available in .3- and .5-millimeter leads, which closely

match common pen tip widths. The plotter senses the type of pen or pencil you load and automatically adjusts the downward pressure.

The main advantage of pencils is that they don't dry when you draw long and

complex plots. Pencils are also less costly than some types of pens, and they can write faster. The Mutoh pencils use a proprietary design in which the lead is held in a cartridge. A rigid rod is inserted into the cartridge to maintain pressure on the lead.



FACT FILE

Mutoh IP-500A

Mutoh America Inc.
895 Cambridge Dr.
Elk Grove Village, IL 60007
(312) 952-8880

To order, call:

Graphic Resources Corp.
4330 Santa Fe Rd.
San Luis Obispo, CA 93403-3459
(805) 546-9797

List Price: \$5,900

In Short: A solidly constructed D-size multi-pen plotter that produces accurate plots with reasonable speed. Can plot with special pencils as well as pens. Competitively priced.

CIRCLE 063 ON READER SERVICE CARD



The Mutoh IP-500A (above) is a D-size model with an eight-position rotating pen carousel. The operating panel (left) is a 24-position membrane array and has an alphanumeric LCD panel with two rows of 20 characters each.

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■ PLOTTERS

When the lead wears down, the plotter automatically switches to another cartridge from the carousel. With eight pencils loaded, a very complex plot can be drawn.


If you thought that pencils were appropriate only for drafts, you'll find the special Mutoh leads provide surprising black opacity. Professionals can make dyeline prints from the plotted original that look as if ink has been used. Mutoh claims professional users can save up to \$1,000 per month with the pencil system because of the extra speed and longer life as well as the lower cost of pencils.

The IP-500A features an alphanumeric LCD panel with two rows of 20 characters each. The panel is used well by the operating firmware and shows an unusually comprehensive array of operating information, including pen velocity and other relevant factors. The operator panel is a 24-position membrane array that provides complete control over the plotter's operating parameters.

The IP-500 includes both 8-bit (Z80A) and 16-bit (68000-12) dual processors. Advanced internal features include moving-coil pen manipulation, adjustment of pen movement by examining the angles to be plotted, and look-ahead reading of line segment data.

The IP-500 emulates a Hewlett-Packard 7580 and its HPGL plotter language. AutoCAD ran with it with no problems. Plot quality was excellent, with solid diagonal lines and fine matching. We tried a variety of pens supplied by Mutoh, and the results with fiber-tip pens, disposable liquid-ink pens, and pencils were exemplary. Plot times were good. The small difference in plotting time between the one-color and four-color shuttle (3 minutes and 1 second versus 3 minutes and 10 seconds) highlights the efficient pen-changing mechanism. The Mutoh IP-500A generally was faster than several of the other D-size plotters, but it's not as quick as the Optical, HP, and Bruning Zetadraf (see "Big Draws: The New Large-Format Plotters," *PC Magazine*, Volume 6 Number 11).

Overall, we're impressed with the Mutoh. It is solidly constructed and reasonably fast and accurate. The plots it produces are excellent. It's also priced competitively—nearly a hundred dollars less than the Western Graphtec PD9111 and



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- 80286-10 CPU running at 10 MHz
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■ PLOTTERS

several hundred dollars less than Cal-Comp's \$6,495 equivalent D-size plotter (see "Big Draws: The New Large-Format Plotters").

OPTICAL COMPUTER INC.

OCI 928

Optical Computer has an excellent reputation in the high-end plotter pantheon. The OCI 928 is a massive, \$8,900 E-size plotter that uses eight pen-rotating carousels. Three different self-capping carousels are supplied—one each for fiber-tip, roller-ball, and drafting pens. The plotter senses the turret type and adjusts speed and downward pressure. This precludes mixing pens of different types for one plot. The carousels accept standard Hewlett-Packard-style pens, so you have access to a staggering variety of pen types, colors, and inks.

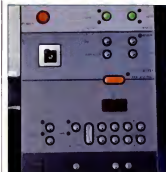
Like most large plotters, the OCI 928 uses dual pinch rollers and vacuum hold-down to secure the medium. One of the pinch rollers is movable to allow plotting on A- through E-size medium. The medium load and unload functions are electronic, activated by push buttons on the panel. The plotter automatically scans and senses the size of the medium.

The front panel is one of the most distinctive aspects of the OCI 928. It doesn't include the LCD panel that is becoming common on large plotters, which is something of a shame; you get used to those English menus and informative messages. On the other hand, the OCI 928 panel has a few more buttons than most, and a lot more LEDs. There are 14 LEDs to indicate

the plotter's status, as well as a large three-digit display that shows the pen number, speed, and downward pressure at all times. A joystick, which you can use to move the pen head, is standard equipment. The styl-

ing of the panel is unusual, with a strongly European, Braun-like design flavor. Overall, we found it informative and enjoyable to use.

The interface is set using DIP and rotary



Optical Computer's OCI 928 (above) is an E-size plotter that uses eight pen-rotating carousels. The operating panel (left) has 14 LEDs, a large three-digit display, and a joystick.



FACT FILE

OCI 928

Optical Computer Inc.
1832 South 3850 West
Salt Lake City, UT 84104
(801) 972-6288

List Price: \$8,900

In Short: A solid E-size multipen plotter that combines high speed and fine plot quality. Unusual and functional operator panel and unique European styling.

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■ PLOTTERS

switches rather than via nonvolatile memory and display menus. This isn't as elegant an approach, but it's fully workable. Both RS-232 and IEEE interfaces are standard. Interfacing was a plug-in-and-run affair.

The OCI 928 emulates the HPGL commands of HP's 7585B plotter; therefore, software compatibility is essentially universal. In our tests, performance was very good. Plot speed was fast. Plot quality was also very good, with solid diagonals and excellent accuracy. Pen changing was flawless, but a bit on the slow side compared with some other plotters in the same class.

The OCI 928 radiates an aura of timeless solidity. While it may lack some of the niceties found in its competitors, it more than compensates with fine performance.

WESTERN GRAPHTEC INC.

Western Graphtec PD9111

The Western Graphtec PD9111, which lists for \$5,995, is a heavy-duty D-size plotter. Its rotating pen carousel holds only four pens, rather than the customary eight. Most users don't really need more than four pen stalls for most of their plots, but if you routinely produce multicolor plots with varying pen widths, the PD9111 may not be for you. The carousel senses the types of pens inserted and adjusts speed and downward pressure accordingly, and it caps the pens when not in use to prevent them from drying out. Western Graphtec's manual discusses only fiber-tip, ceramic,

and refillable liquid-ink pens.

The PD9111 uses a mechanical lever to invoke the medium hold-down system, which consists of vacuum and pinch wheels. One pinch roller is movable, to al-

low the use of A- through D-size media. Once you move the hold-down lever, the plotter scans the medium to determine its exact size. There isn't any automatic skew adjustment, but manual alignment to pre-



FACT FILE

Western Graphtec PD9111

Western Graphtec Inc.
11 Vanderbilt
Irvine, CA 92718
(800) 854-8385
(714) 770-6010
List Price: \$5,995

In Short: A competent, heavy-duty D-size plotter with just four pens instead of the six to eight that you normally find. On the slow side, but it generates excellent plots.

CIRCLE 881 ON READER SERVICE CARD



The Western Graphtec PD9111 (above) is a D-size model with a rotating four-pen carousel. The operator panel (left) consists of 17 push buttons, four LED indicators, and a two-row by 20-character LCD.

printed media is provided.

The operator panel consists of 17 positive-action push buttons, four LED indicators, and a 2-row by 20-character LCD. Two more buttons, a contrast control for the LCD and an eight-position DIP switch are hidden behind a small door below the panel proper. There's nothing particularly fancy or visually attractive, but the control system is functional and gets the job done.

Serial, Centronics parallel, and GP-IB (IEEE) interface ports are available. The unit comes with both serial and Centronics ports. The serial interface is configured with an eight-position DIP switch. Given AutoCAD's inclinations to drive HP plotters only serially, we used the serial port in our tests. Our sample PD9111 arrived configured correctly for AutoCAD, and it was a plug-in-and-run proposition.

The PD9111 includes HPGL emulation, which provides almost total software compatibility. It also includes Western

EDITOR'S CHOICE

• Houston Instrument DMP-61

Although we were pleased with several of the plotters in this batch, one plotter clearly stands out, whether compared with the other devices tested here or with competitors from previous reviews. Houston Instrument's new DMP-61 delivers a remarkable combination of high speed, gorgeous plots, and very competitive price. We think it will do nicely in the plotter market.

Graphtec's proprietary GPKL graphics language, which most are unlikely to use. Plot times in our tests were on the slow

side for a plotter in this class. We tested the PD9111 with the disposable liquid-ink pens supplied. Other pen types would likely plot at faster times.

Plot quality was excellent, however. The pen-changing mechanism was again on the slow side, as indicated by the extra time taken for the four-color shuttle plot (although the ratio between one-color, which took 649 seconds, and four-color, at 318 seconds, isn't that bad).

Western Graphtec's tech support staff asserted that this didn't much matter, since many users will choose ink pens that must be run at reasonably slow speeds anyway. There is some logic to this view if you plan to use only liquid-ink pens, but we prefer a plotter that can draw at high speed with appropriate pens. Not everyone uses liquid ink for work in progress.

Glenn A. Hart is a contributing editor of PC Magazine.

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SELLING WELL: THE POWER OF TELEMARKETING SOFTWARE

These programs, priced from \$395 to \$1,200, help you clinch sales by putting the power of databases and word processors to work on your call lists and client histories.

Telemarketing is the white-hot core of many sales campaigns, one of the most popular direct-sales methods. The reason: it's a whole lot cheaper than making sales visits. By some estimates, a telemarketing call is about $\frac{1}{30}$ of the cost of a personal call. It should come as no surprise, then, that telemarketing software has become increasingly prevalent in the past few years. These packages support a very popular sales technique

SCREENING TELESales

Some screen designs are more intelligent and intelligible than others; use of color, menu placement, and information density all play a part.



PCAT alerts you to the next call to be made on your call list. At this point you have the option of deleting the call from the list or changing the date, time, or frequency of the call.



SpaceBase provides excellent tracking for the advertising industry. It keeps tabs on agencies, contracts, discounts, target markets, activity of the competition, distribution channels, objectives, and scheduling.

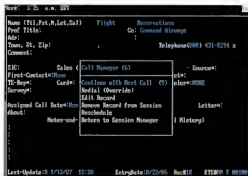


Exsell's screen has information on the program and your client. In the upper right, you are given options from the Systems Menu.



Display the history of the last 10 contacts made with active client.

SaleMaker's screens are busy, but they provide a wealth of information, including your last ten contacts with each client.



TelePro PC's Call Manager has a pop-up menu that gives you the option of following the call list, going on to the next, redialing, editing the client record, removing the record, or rescheduling the call.

and, at the same time, make that technique even more efficient.

One of the first personal computer telemarketing programs was *PCAT* (The Personal Computer Automated Telemarketing System), introduced in late 1982 by Arlington Software + Systems Corp. of Arlington, Massachusetts. That product is now in its fourth incarnation and a fifth is on the horizon. Sharing the market are the products we review here. Ranging in price from \$395 to \$995, they include *Exsell* from Excalibur Sources; *SaleMaker*, from Software of the Future; *SpaceBase*, from Stadis Corp.; and *TelePro PC*, from Travis DataTrak.

Others have entered the market since we reviewed these packages. One of the most novel, by virtue of its packaging, is an Australian import—*Tracker*, which is billed by its manufacturer, Sofcode Pty. Ltd. and Adaptive Electronics Pty. Ltd., of Melbourne, as "THE Interactive Filing

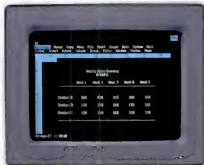
and Prospecting Software," and displays, on the disk cover, a full-color photo of an Australian aborigine in a loincloth, poised in the outback. *Tracker*, which can keep track of accounts, prospects, call lists, and the like, is distributed in the United States by Adaptive (USA) Inc. of Newport Beach, California. Another newcomer is *ACT!*, from Conductor Software of Irving, Texas (see First Looks, *PC Magazine*, Volume 6, Number 16). More generic search-and-retrieval databases such as DayFlo Software's *Tracker* (a stateside product out of North Irvine, California, that is unrelated to the Aussie program) or *Inside Track II* from I-Track Corp. of Plano, Texas, also can be set up to track sales and client information.

Telemarketing programs borrow features from other popular software. They maintain client databases, communicate to the telephone, and perform word processing jobs. And although they are principally

used interactively, while the salesperson is on the phone, they can double as pure direct-sales packages because they support in-person selling methods.

At the heart of these programs is the customer database. No salesperson could get very far without his account book, and that's what you find in the database—the accounts, stripped of their calling and letter-writing facilities. There you can keep customer information and the history of sales calls.

The best packages offer both a good range in fixed-data fields and at least several user-definable fields. Offering the users a chance to create their own data fields lets them customize the program to their particular business needs. A life insurance company, for example, might choose to record the general health of its customers, whether or not they smoke, the size of their policy, and so on. On the other hand, a robotics manufacturer might want to keep in-



Quick—turn the page.

■ TELEMARKETING SOFTWARE

formation on the square footage of a customer's plant, the volume of production, and the age of its equipment.

The customer database acts as more than an electronic sales memory. It can also be the key to analyzing prospects. If the telemarketing program has a robust, flexible search procedure it will permit a layered multiple search so you can fix your sales sights on the hottest prospects. A multiple search will let you sift through the database with a fine sieve and hold on to the prospects that fit most closely the profile of your best clients. This profile might contain a half dozen or more characteristics, such as SIC code, geographic location, number of employees and/or revenue size, and other attributes that relate directly to the products you sell. If all you can do is search for a company or contact name, your telemarketing program isn't giving you good value.

CALL MANAGEMENT Of course, the first part of call management is building call lists. You do this using the search techniques in the program, but you also want to be able to sort search hits in several different ways and maintain the call lists for a period of time.

Richer features of call management include the ability to automatically dial phone numbers and handle incoming calls without having to back out of the customer record that you have on the screen. The best programs will even let you call a list of clients in succession, adjusting automatically to busy signals and unanswered calls.

Finally, there has to be some way to record information—statistical and textual—on the calls themselves. Stats on the number and length of the calls made can give clues to how effective you are on the phone and can help you plan big campaigns. The textual history of calls gives you more information on your clients and their needs and can provide an important chronological record of the sale.

The other functional areas of telemarketing programs can be lumped together under letter writing and reporting. Creating and sending form letters and other mail is an important adjunct to the sales call. All of the packages we reviewed will let you do some letter writing, but again, the best programs let you do more, such as mail-

merge and mail tracking. But even the most sophisticated of the telemarketing programs can't compete against the top word processing programs when it comes to writing capabilities. So, telemarketing

■ **Screen design and color are features to consider. A few telemarketing products have gone further than others in offering visually exciting packages.**

packages that let you export mail-merge files to word processors are very appealing. None of the programs we reviewed spent a great deal of effort on reporting facilities, although there are a couple that allow you to do more free-form database query reporting—definitely a plus.

Telemarketers may sit in front of their monitors all day long, so screen design and use of color are also features to consider. A few have gone much further than the others in offering visually exciting packages.

Another part of the design equation is the way functions are initiated and the way you move through program operations. Some of the programs we reviewed let users wield commands by just typing the first letter of a menu selection. This is often the fastest approach and is generally combined with the ability to use the arrow keys for scrolling through menus. But some of the programs are still stuck at the caveman level of personal computing, and only let you scroll up and down without a way to jump from the top to the bottom.

Each of the programs has its tricks for speeding up field entry. Some let you fill fields by menu selection. Some let you repeat previous entries, and others let you scroll through possible selections directly in the fields.

In the end, the program you choose should offer a balance between functionality and feel. Salespeople each have their own style, and any program that will be


used as much as this one should be as comfortable as the briefcases they carry.


Exsell

Exsell, a \$395 program from Excalibur Sources, is not an elegant program. Its screens are mostly monochromatic; there are few pop-up windows and you have to scroll to menu selections. But in its straightforward, simple manner the program does have some good features. For one thing, it is easy to learn and to use. For another, it has commendable call-management abilities.

The most extensive features in *Exsell* are reached through the System Menu. The first selection on this menu is something of a grab-bag command called "Get." Pressing Return with the cursor at Get tells the program you want to display prospect information. *Exsell* responds with a prompt at the bottom of the screen: "Enter Prospect." Here you can enter a full name or part of a name, and the program will hunt for the closest match. If the name it displays at the bottom of the screen is wrong, you can scroll forward or backward through the database; if it's right, pressing Return brings up that client's basic data record. The information in the record appears to the left of the System Menu window, on the top half of the screen.

The Get command can produce other results if you type in one of the single-letter designations that follow in parentheses.

**FACT FILE**

**Exsell**
Excalibur Sources Inc.
P.O. Box 467220
Atlanta, GA 30346
(404) 956-8373
List Price: \$395
Requires: 128K, two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: *Exsell* is a happy medium between a real bare-bones program and one that is rich in functionality. It is menu operated, has very good search procedures, and does a nice job of call management. Copy protected.

CIRCLE 643 ON READER SERVICE CARD

For example, pressing P is a shortcut to the Phone command, listed further down the System Menu. This command automatically telephones a prospect. If you press T while the cursor is on Get, it brings the up the Tickler file, which lists all the prospects who are to be called on a particular day, or who were supposed to be called earlier but weren't. The prospects are listed in chronological order (the oldest first). The Tickler can hold up to 160 entries.

A number of other selections on the System Menu give you call-history information: a Contact History, an Order History, a Quote History, a Comment file, and a Response file. When any one of these is retrieved, it fills in the lower half of the prospect information screen. None of these files has a great deal of space. The three History files are each nine lines long; each line has a date and 48 characters of space for comments. The tenth call or order appears on line 9 and all the others move up

one position, erasing the first and oldest record. The Comment and Response fields are also limited, but a nice feature of the Response file is that you can enter one of 20 standard responses just by typing a number.

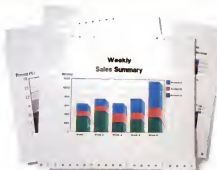
WHEN SOMEONE ANSWERS Activating the phone command on the System Menu will bring up a Call Status menu. If you select the Answered command, another menu comes up that lets you indicate whether the prospect will return the call, or is out until a particular time, or needs to be called again. You can also choose to enter a comment. If you select Contacted, yet another menu comes up that allows you to enter a comment or response. All of these calling menus appear on the bottom right-hand corner of the screen, so they don't cover up any of the prospect data during a call.

The information maintained on a prospect

is somewhat limited. There is room for only one prospect name and phone number; the company name and address, one line of comment, the last contact date, and the next contact date. There are also six user-definable fields.

When you enter new prospect information, the program can perform one very useful trick. If you press Ctrl-R while the cursor is on any field, the data from the last entry you made in that field (during the same session) will be automatically entered. This saves a great deal of time if you are entering several prospects at once in the same geographical location or at the same company.

One of the most flexible features in *Ex-sell* is its search procedure. You can search for prospects using any one of the information fields, except for the first name, title, street address, and phone number. In addition, you can search all the History files and the Comment file or perform multiple



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TELEMARKETING

searches. The multiple searches can include any combination of fields possible in single searches, giving *Exsell* a very robust search capability. You can even search by excluding particular field values. For example, if you enter "<> New York" in the city field, you could search for all prospects in the state of New York who are not in the city of New York.

When a search is complete you can sort the results by last name, company name, or next contact date before the list is displayed on the screen.

Exsell also has a built-in word processor that can be accessed from either the Main Menu or the System Menu. The word processing functions are very basic, but you can easily create letters to clients, perform mail-merge functions, or produce labels and envelopes.

While *Exsell* does not exactly excel as a telemarketing program, it is basically a good program that can be useful to a salesperson who doesn't demand a great deal from it.

PCAT

PCAT (The Personal Computer Automated Telemarketing System), from Arlington Software + Systems Corp., is a barebones program with an expensive price tag of \$1,200. Its searching capabilities, which can be used for call selection and analysis, are pretty good, but the client records are only adequate and there is little room for call history. It doesn't have the



FACT FILE



PCAT, Version 4.0
Arlington Software +
Systems Corp.
400 Massachusetts
Ave.
Arlington, MA 02174
(617) 641-0290
List Price: \$1,200

Requires: 384K RAM (512K RAM recommended), two disk drives, DOS 2.0 or later.
In Short: A limited package with only adequate client information and skimpy call history. Hard to justify the program's high price. Copy protected.

CIRCLE 642 ON READER SERVICE CARD

ability to handle incoming calls without exiting the screen you are in. PCAT was one of the first telemarketing packages available for personal computers, and the program feels like a throwback.

The installation procedure is a good example of the program's creaking style. To start with, you have to create a subdirectory on your hard disk, then copy the program files over to it using the DOS COPY command. After that you have to run a lengthy question-and-answer configure routine, followed by another routine for setting up the customer database. Finally, you have to run yet another routine that moves the copy protection to your hard disk, so you can operate the program without the key disk in the A drive. If you need more than one customer database, the process is twice as lengthy. (The company says that the next version of the program, Version 5.0—due out in November—will have an automated installation procedure.) Even after the program is installed, you still have to respond to a prompt to identify the disk drive every time you boot the program.

PCAT is run by function keys, not menu selections. The main menu comes up with a list of ten commands and the corresponding function keys. To add a new client to the database you press F4. The client record is split into two areas. The top half of the screen holds the basic client data and the bottom half has nine blank lines for notations. This is the only place to maintain a call history. The first note line can be used for a shipping address, if it is begun with the "@" symbol.

LIMITED FIELDS The data fields at the top of the screen cover little more than the basic customer information: customer name (company), contact name, address, phone number, customer number, and so on. There are no fields for a second contact, a contact's title, or more than one phone number. You can't record SIC codes, the number of employees, annual revenues of the company, the source of the prospect, when contact was first made, and the like. To compensate for these omissions, there are only two undefined fields: User1 and User2. Whatever other information you want to record has to go into the notepad at the bottom of the

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■ TELEMARKETING SOFTWARE

screen—but if you use it for basic data, you lose precious space for call history.

There are only two fields of note in the client record. The first is the Frequency Days field, which lets you indicate the number of days between calls if you want to call on a cyclical basis. The second is the Time Diff Hours field, which lets you record time-zone differences between you and your client.

Once a database is built, one of the most important uses of the system is Make Call Lists. While PCAT's search procedure is pretty good—allowing you to search on four fields at once—you have to learn some special field names and constraint codes to use it.

Most of the field names are obvious, but some are not—like Recalcat for the recall date, and Update for the operator number, recall date, time, and priority all grouped together. The search constraints—called verbs here—are two-letter

codes, like GE for greater than or equal to, or CN for contains. While filling in the search form, you can scroll through the field-name and constraint-code choices and enter them with one keystroke. This

■ PCAT has an alarm that will beep at a specific date and time and bring up a short alarm message.

makes their use somewhat easier, but you still have to remember their definitions or look them up.

Unfortunately, the search procedure is further complicated by a set of cryptic rules. If you don't pay attention to these

rules, you can get erroneous results without even realizing it.

One of the other shortcomings of the program is the inability to save your place in a record while taking an incoming call. (According to Arlington Software + Systems Corp., this will also be fixed in the next version.)

One of the things this program does well is create form letters that can be customized to an individual client's interests. Unlike many other telemarketing programs, this customizing feature is not restricted to the name, address, and salutation—it extends to the body of the letter for a word or phrase. But setting up form letters is not a simple matter—you have to learn formatting commands and field-substitution commands.

A few of the other pluses in this program are in the Other Options menu. For example, you can set an alarm that will beep at a specific date and time and bring

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up a short alarm message. From this menu you can also display the status of *PCAT* and the customer database, or enter *DOS* commands without exiting the program. But all the program's pluses don't seem to outweigh the major omissions, and they certainly can't justify the price.

SaleMaker

Few programs that are as functional as *SaleMaker* are also as appealing to work with. There is nothing inherently graphic about telemarketing information, but *SaleMaker*, a \$495 program from Software of the Future, uses color and graphics tricks to make every screen visually pleasant and to increase the user's grasp of information. On the functional side, the program is rich in call-management and database facilities.

SaleMaker is a very easy program to learn and to use. A demo disk contains both a quick overview of the program and a fully interactive learning session that lasts 30 to 45 minutes. After the interactive learning session you should be very comfortable with the program.

SaleMaker's main program menu has five title boxes across the top, with shadow outlining to make them stand out from a green matte background. As the screen comes up, the middle box, Maintenance, drops and a menu window opens under it. The first selection in the window, Add

New Client, is highlighted in reverse video. As you move across the titles with the arrow keys each of the other titles—Make Calls, Planning, Reports, and Exit—drops down and a menu window opens below it.

You can make a menu choice by typing the first letter, an important feature for users who are talking to a client on the phone as they use the system.

Maintenance, as the name implies, is the central repository for all the client information and the place where additions and changes are made. The client information screen is broken into boxed sections to increase the visual read. In addition to the typical name-and-address type of information, *SaleMaker* has some unique fields. For example, in the upper-left-hand corner of the screen is a box labeled "Objectives of this Call." It has room for three objectives, their explanations, and whether or not the objectives were met. This information actually gets entered when you make a call, but the objectives from the previous call are maintained until you change them.

Another unique feature of the client information record is the six user-definable data fields in the middle zone of the screen. These fields can be customized to apply to a particular type of business. For example, an insurance company might use these fields to enter the general health of a person, date of birth, whether or not the person is a smoker, the amount of coverage, and so on.

The commands under the Planning title box allow you to put clients in a call list, so you can organize the day's activities. You can have up to nine active call lists, each with up to 99 clients in them. To put clients in a list you use one or more search routines, which are entered into two search boxes that appear at the top of the screen. The routines consist of a number designation for a data field to be searched, a search constraint, and a field entry. The first two parts can be selected off menus by pressing the Tab key in the appropriate fields of the search boxes. The last part has to be typed in.

For multiple searches you fill in both search boxes, then pick the "and" or "or" connector from a narrow, horizontal box below them. There is also a third search routine available, (although it isn't documented in the manual), which is activated

by pressing the "O" key at the prompt to start or abort the search process. Software of the Future says it plans to document this in the manual of the next release. This adds flexibility, but some other packages allow you to specify more search parameters.

AUTO-DIALING Once a call list is put together, you go over to the Make Calls menu. The first selection is Begin Call List. This is where most of the action in the program takes place. For starters, you can view the client information, set call objectives, or take a look at the program's bulletin board to see if there are any special messages or promotions. Then you can have the program automatically dial the client's phone number.

■ *SaleMaker* has some unique fields, for example, "Objectives of This Call." It has room for three objectives and their explanations.

Once you've reached a customer, you can access sales and product scripts by pressing F10. The program can accommodate nine scripts of 99 pages. Once a script is called up, you can go through it in sequential page order or pick a page number by scrolling through a page index. This extensive script facility can be used in many ways by both experienced and inexperienced telemarketers.

At the end of a call there are pop-up windows that allow you to enter call results and new objectives for the next call, set an appointment, make notations, and indicate which literature should be sent. All these entries, as well as timing information on the call, become part of the permanent call history for the client and can be accessed from a number of pop-up windows in different parts of the program.

The Reports menu is the final functional area in *SaleMaker*. Its selections let you



EDITOR'S
CHOICE

FACT FILE



SaleMaker
Software of the
Future Inc.
Box 531650
Grand Prairie, TX 75053
(800) 433-5355
(214) 264-2626
List Price: \$495, single-
user version.
Requires: 512K RAM (640K RAM recom-
mended), hard disk, DOS 2.0 or later.
In Short: SaleMaker is a very well rounded
system with broad functionality and excellent
screen design. It is also fast and easy to op-
erate; a hard package to beat, especially at its
relatively low price. Not copy protected.
CIRCLE 644 ON READER SERVICE CARD

■ TELEMARKETING SOFTWARE

print out a daily call summary, produce labels for the clients in a call list, print a list of clients to be called back within a specified date range, or print out client information by client name or call list. Like the other features in *SaleMaker*, the Reports are easy to use and show how complete the program is. This is all the more remarkable in light of its relatively low price.

SpaceBase

SpaceBase, from Stadis Corp., is different from other telemarketing programs because it is focused on one specific type of sales: ad space. In order to handle this marketplace, the program has to maintain information on two different types of customers—advertisers and agencies. But *SpaceBase* goes far beyond necessity to offer comprehensive information that is unrivaled in other telemarketing/direct marketing packages. The program is also very

capable when it comes to taking orders and producing reports, and it sells for \$695.

**FACT FILE**



SpaceBase
Stadis Corp.
15716 Wing Point
Dallas, TX 75248
(214) 991-0010
List Price: Level I single-salesperson version, \$695; Level II multiple-package version \$1,795 (up to 26 sales, not a network version).
Requires: 512K RAM (640K RAM recommended), two disk drives, DOS 2.0 or later.
In Short: An excellent package for a vertical market, ad sales, though only people in that business should consider it. Not copy protected.
CIRCLE 840 ON READER SERVICE CARD

SpaceBase is easy to use and employs modern ideas in the use of color, pop-up windows, and maneuverability through the program operations. At the same time, the screens are designed to be as simple and clean as possible. To this end, some of the field names will disappear from the screen after data is entered. This is true of the name and address fields, for example. If certain information is not filled in, like a home telephone number and address or a spouse's name, then the fields don't appear on-screen at all.

You can make menu selections and choose commands by either scrolling through the choices or pressing a number indicator. Some questions are also yes/no, so you can move through the screens or initiate commands very efficiently.

SpaceBase contains a number of databases—one each for advertisers, agencies, and people, and others for ads, call reports, and form letters.

Ideal Working Condition



If you're looking for a high-speed laser printer that can easily handle as much as 25,000 pages a month, the new Toshiba PageLaser 12® is the machine for you.

It thrives in any high-volume office environment. Whether it consists of a productive single user, or a network of multiple users sharing the workload.

PageLaser 12's extended product life might help explain its hard-work mentality. At up to 1.2 million pages, it's three times more durable than other laser printers. And better still, at 12 pages

per minute, PageLaser 12 is up to 50% faster than many other laser printers.

You'll also have an equal appreciation for its advanced paper handling options. Like its fully-integrated automatic envelope feeder. This option lets you print large quantities of envelopes—up to 100 at a time—without constantly banging away on your office typewriter.



The agency data record requires the least information. Its only fields are the agency name, address, telephone number, and material contact (the person at the agency contacted for photographic negatives, artwork, ad copy, and so on).

By contrast, the advertiser record contains a great deal of data. In addition to the standard name-and-address type of information, it also records the agency used, billing frequency, annual advertising budget, rate card number, the date the ad contract started, and the starting date of the fiscal year. There is also a section for product information, including primary target market, major competition, channels of distribution, and advertising objectives.

The record for a person working at either an agency or an advertiser is the same. It includes the company name and address; the person's first, middle, and last name; a salutation; and a title. Then up comes a series of pop-up windows for further infor-

mation that is particular to ad sales. This includes the title category of the person (so people are identified functionally, no matter what their official title is), his influence on advertising, his importance in advertis-

■ After one or more ads are entered in *SpaceBase*, the information can be used to produce reports.

ing decisions, whether or not he should receive a checking copy of a publication, and the other types of mailings he should receive. In addition you can enter the person's birthday, spouse's name, home address and phone number, and the date of

last contact. There is also a free-form note field at the bottom of the record.

Agency and advertising records can be linked together by assigning an agency to the advertiser. Then, when you are in a linked record you can flip back and forth between the advertiser and agency simply by hitting one key. This is very helpful while you're on the telephone discussing an ad.

The search features in *SpaceBase* are its weakest element. But since the program is not primarily focused on telemarketing, this may be understandable. On-screen searches are limited to names. You can use a full name or a truncated version of it. In the mail-list portion of the program you can perform complex, multifield searches, but the results must be printed out.

Ads and ad reports are naturally very important parts of this program. It is here that the salesperson gets to record ad orders and track them over time. The ad re-

s For The PageLaser12.



What's more, our dual-bin paper feeder, combined with PageLaser 12's standard cassette feeder, provides a paper capacity of 750 sheets.

So now, with a total of three paper feeders, you can print letter and legal sizes, or even labels and envelopes, automatically.

As for multiple emulations, HP LaserJet 500 Plus,® Diablo,® IBM® Graphics, Qume® and Toshiba P351 all come standard, as do parallel/

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Toshiba America, Inc., Information Systems Division

serial interfaces.

So if your business prospers on high volume, get the laser

printer that does the same. The PageLaser12.

For a PageLaser12 demonstration, call 1-800-457-7777 for the name of the Toshiba printer and computer dealer nearest you.

Then see how well PageLaser12 performs in your surroundings.

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TELEMARKETING SOFTWARE

cord can even be used by the salesperson as an ad hoc quoting system. If you enter the ad specifications you will get a total cost. After you quote it to the client you can choose not to save the record, freeing

the screen for another quote calculation.

The information recorded on an ad—through pop-up windows—includes the issue date it will be in; its size, position, color, and title; whether it has a coupon or

reader service card; and whether it is to have a bleed.

After one or more ads are entered, the information can be used to produce a number of reports. You can list ads by future issues, or the ads in one issue, and you can get a summary of revenue by the issue or by advertiser.

Other reports *SpaceBase* can produce include a list of upcoming appointments, a history of past contacts, and company profiles that have the company information as well as a list of all employees.

SpaceBase also has a simple word processor for generating letters, envelopes, and labels. It can handle mass mailings on its own or produce mail-merge files for *WordStar*, *WordPerfect*, *NewWord* and *XyWrite*.

Rounding out the excellent features in this program are routines for backing up and restoring the database, and a pop-up calculator. There seems to be nothing left out of this vertical market package.



WORLD's First Multifunction Board and PS/2 Family From Zuckersboard

Zuckersboard's NEW Micro Channel line satisfies all your PS/2 add-in board needs!

Two of the hottest stars in the Micro Channel line are the 50/60 Multifunction Board and the Format Converter.

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The memory is both EMS and extended or a combination of both. The 50/60 Multifunction Board can expand the Model 50 to 7 Mbytes and the Model 60 to 15 Mbytes. Other standard features include a serial adapter and software for print spooling, EMS simulation, and diagnostics.

The Format Converter saves you the expense of buying duplicate software by allowing you to transfer data from IBM's old 5.25" format to the new PS/2 3.5".

Zuckersboard's Micro Channel PS/2 family has everything you need — with the highest quality and the best price/performance ratio, all with a five-year warranty.

MICRO CHANNEL LINE SELECTION CHART

PRODUCT NAME	MODEL NO.	PC MODEL				PRICE*
		486	286	486	286	
50/60 Board (with 2Mbytes)	1000	X				\$300
10 Board (serial/parallel and internal serial options)	1045	X				\$100
Internal Modem (1200 baud)	1050	X				\$120
Multifunction Board (512K, 4 or 8 Mbytes memory)	1090		X	X		\$770/\$850/\$940
Universal Modem (1200 baud)	1095		X	X	X	\$800
Format Converter	1096	X	X	X	X	\$ 30

*Prices are subject to change without notice.

For more information see your local Zuckersboard dealer or call 1-800-624-4920 (US) or 1-800-618-6300 (CA).

It's another
ZUCKERBOARD

ATD/Zuckersboard
235 Santa Ana Court
Sunnyvale, CA 94066
(408) 720-1942

CIRCLE 106 ON READER SERVICE CARD

TelePro PC

It's a good thing we all know about first impressions. *TelePro PC*, a \$995 program from Travis DataTrak, does not make a great first impression. Its screen design shows a taste for minimalism, and its minor inconsistencies in moving through the menus make the program look limited in functionality. But the longer you work



EDITOR'S CHOICE

FACT FILE



TelePro PC

Travis DataTrak
381 Elicot St.
Newton, MA 02164
(617) 964-8960

List Price: \$995; with
dialing board, \$1,050.

Requires: 512K, hard

disk, IBM PC XT or compatible (AT-class machine is recommended for the speed and performance capabilities), DOS 2.0 or later.

In Short: A richly featured program that gives a salesperson a good balance in call-processing and analysis features, but is somewhat pricey and difficult to learn. Copy protected.

CIRCLE 636 ON READER SERVICE CARD

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It's another Zuckersboard is a registered trademark of Advanced Telesystems, Inc.

with the program—and it does take time to learn—the greater your appreciation for its depth and the range of its abilities in both call management and analysis. Over time, even the screens acquire a certain clean, simple appeal.

For many salespeople, the call-processing part of this program will be where they spend most of their time. It is in this mode that all the customer information is added, product information and scripts are consulted, calls are made, and results are recorded. Underlying all these operations is the client database, which is built by filling in a contact document form for each client. Blank forms are accessed by choosing the New Contact selection in the New Entries pop-up window.

Just as an aside here, menu selections in this part of the program can be highlighted by using the arrow keys or the first letter of the selection. The latter approach is naturally much faster, but it's not used throughout the program. And unlike other programs that employ this technique, some choices have the same first letter, forcing you to press the key several times and then hit Return to make the selection complete.

The information on the contact document screen is formatted into three primary sections. The top fields are the name-and-address blanks. The middle fields hold a mixture of information on the company and telemarketing information, such as SIC code, sales revenues, the source of the client, and when the first contact was made. The last area details the next call date, what the call is about, and letters to be sent. Under these fields are five blank lines for comments.

Very often, the contact document will be filled in while the telemarketer is on the phone. For this reason speed is important, and that's where *TelePro's* look-up screens come in handy. Fields on the document marked with an asterisk have a related look-up screen. When the cursor is on one of these fields, pressing the F1 key will pop up a screen of appropriate choices that can be highlighted and transferred automatically into the field. There are 12 such fields on the contact document.

One of the other look-up screens is for the field called Survey. This look-up screen holds the text of a multiple-choice

survey questionnaire. As the client responds, his choices are recorded and later displayed on the Survey line of the document. The program comes with a sample survey, which can be rewritten to suit your situation. The text limit is 30K, but only 10 to 25 answers will fit on the survey line, depending on your answer code.

Other scripts for the telemarketers can be written into an area of the program broadly labeled Help On, which is reached through another pop-up window. One of the Help On choices is Products, which can have as many as 128 branching screens of information, including prices, specifications, the competition, and sales pitches.

In addition to storing the basic client and product information, you get to record the history of all your calls. This history tells you the date of a call, when it started and ended, and its elapsed time. The call record also has room for three lines of notes for customized annotations.

PC EDITOR'S CHOICE

- SaleMaker
- TelePro PC

Two of the general-purpose telemarketing programs stand out—each in its own way. TelePro PC is perhaps the package with the most features. It strikes an excellent balance of analysis and call management features, but it has a hefty \$995 price tag and takes effort to learn.

SaleMaker shines because of its superb screen designs and its ease of use. It is also a fairly broad package, but without the depth of a program like TelePro, and it sells for the attractive price of \$495.

As a very specific program geared at the ad sales market, SpaceBase deserves consideration from those in that industry. At \$695, it is an excellent package for advertising sales. If that's your business, this one from Stadis Corp. merits your attention.

Two powerful call-processing features are the ability to take incoming calls without backing out of another customer record, and the automatic dial facility. Through the New Entries menu, you can retrieve a new call form that lets you make brief notations and record the time of the call. When you're done, just press Esc a few times and you've stepped back to the client record you were in before.

To use *TelePro's* automatic dialing routine, you have to have a Hayes- or Zoom-compatible modem, or the *TelePro* dialing board, which costs an extra \$55. The automatic dialing routine (called PowerDial) lets you sequentially dial a call list. Completed, rescheduled, and skipped calls are dropped from the list as you go, and the busy or unanswered calls are left on reschedule.

No telemarketing operation can succeed just by calling clients quickly. The other part of the success equation is calling the right clients. With the searching capabilities of *TelePro* you can isolate the characteristics of your good clients, and then use these characteristics to sift through the database for the best prospects.

The database can be searched by any field or combination of fields in the contact document—even the textual fields. The search is focused by using constraints, such as "less than" or "equal to," and by listing the field values to be searched for. You can search on fields separately or in combination, using the "and" and "or" connectors.

TelePro PC has a number of other noteworthy features, including the ability to generate a couple of canned reports on call activity and produce ad hoc reports by querying the database. Of course, you can also write letters and make labels.

While the product is more expensive than some of its competition, there is ample functionality to justify the higher cost of the program. A new version of *TelePro PC*, which came out in October, should expand this functionality. Among its enhancements are unlimited notes capacity and the ability to customize every screen and screen title.

Henry Fersko-Weiss covers technology and computers for several national publications.

BETTER BY DESIGN

When Torrington developed the exclusive Manager Mouse tracking mechanism with its patented suspension, the objective was to create a reliable design which eliminates the maintenance problems inherent in the conventional ball mouse. The result is a simple two-wheel, direct-drive system.

Our tough, hard-urethane wheels actually push dirt and debris away as they track mouse motion. Our suspension keeps the wheels tracking smoothly on any flat surface, at any angle. This adds up to Manager Mouse Performance, smooth, consistent, reliable, trouble free.

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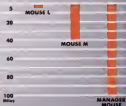
DRIVE WHEELS

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CIRCLE 157 ON READER SERVICE

IT GOES THE DISTANCE

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mouse →

CORDLESS



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■ PC LAB NOTES: DOS COMMANDS ■ CHRIS DeVONEY

PUTTING OLD PROGRAMS IN NEW BOTTLES

By understanding three DOS commands—ASSIGN, SUBST, and JOIN—you can bring older programs that don't recognize subdirectories or hard disks into the modern world.

You don't have to sell today's PC user on the value of hard disks. Not when many software packages require nearly a dozen or more floppies just to hold their programs before installation. And the tremendous speed advantage hard disks provide speaks for itself—so loudly, indeed, that despite their vulnerability to disruptions, even faster RAMdisks are increasingly popular.

Unfortunately, however, there are a number of "oldie but goodie" programs that don't know about subdirectories. Even if you put them on a hard disk, you're stuck with running both the program and its files from the same directory. And when too many files clutter one directory, the speed advantage shrinks as the effort to find files grows.

Even worse are the still-useful programs that don't know what a hard disk or a RAMdisk is. These programs insist on hitting the floppy disk for their files. Some graciously allow you to specify a disk drive—so long as it's either A: or B:. Games and older utility programs are the worst offenders in this category.

Painful as it is to have to use some of these older programs, however, too many PC users needlessly compound their misery by failing to realize that DOS itself provides some workable solutions. The DOS ASSIGN and SUBST commands let you trick your programs (and sometimes DOS itself) into using a different disk drive than the program thinks it is using. Another form of trickery is performed by the JOIN command, which magically turns two or more disks into one. JOIN is particularly

useful when used in conjunction with "sweep" programs that automatically search subdirectories to find files. While these three commands are not the easiest to learn if you don't use them regularly (you

can trick yourself no less than your program!), once you've gone through this issue's PC Lab Notes you'll find they can make many sticky situations manageable.

PRODUCTIVITY INDEX

PC LAB NOTES

DOS commands that teach old programs to use subdirectories.

UTILITIES

PRN2FILE catches hold of printer output and puts it in a file.

ENVIRONMENTS

Powerful video functions from OS/2 without hardware trickery.

POWER PROGRAMMING

Getting into arguments with C and MASM as a matter of routine.

SPREADSHEET CLINIC

How to debug macros, and a bug that hasn't been exterminated from 1-2-3.

USER-TO-USER

A utility that will clear out a subdirectory in one fell swoop.

POWER USER

Fast times on the dBASE strip; top-secret WordPerfect key combos.

LANGUAGES

Eich A Sketch graphics in BASIC; 255 open files with Turbo Pascal.

PC TUTOR

Whether getting your head bounced very fast really does any damage.

CONNECTIVITY CLINIC

Keeping cabdrivers off the phone lines; checking out the latest video.

FOOL FLOPPIES WITH ASSIGN

The ASSIGN command reassigns (re-routes) all activity intended for one disk drive to another drive. ASSIGN was issued originally in DOS 2.0 and it was specifically intended to handle programs whose whole world revolves around drives A: and B:.

The syntax to establish an assignment is

```
[d:][path]ASSIGN d1=d2
```

As an external command, ASSIGN must be loaded from the disk, hence the leading [d:][path] DOS may need to find ASSIGN.COM. The first disk drive name, d1, is the disk drive that your program(s) would normally use. d2 is the name of the disk drive to be used in place of d1. For example, the command

```
ASSIGN A=C
```

reroutes any activity intended for drive A: to drive C:. While the command is active, any reading or writing of files for drive A: occurs on drive C: instead. Note that when entering the command you do not use colons after the disk drive names. ASSIGN objects to the colons. Indeed, under DOS 2, ASSIGN also objected to spaces between the drive letters and the equal sign. ASSIGN under DOS 3 is more forgiving and allows the spaces.

To see just how ASSIGN works, put a diskette into floppy drive A:. Do a DIR

■ PC LAB NOTES

command, first on the floppy (DIR A:) and then on your hard disk (DIR C:). Then enter the ASSIGN command given above and try the same DIR commands again. You should see the directory for drive C: twice, and the floppy in drive A: won't even stir. DOS and your programs now believe the fixed disk C: actually is drive A:.

You can reassign more than one disk drive at a time, provided you put all your reassignments on the same command line and use a space between assignment pairs. Thus, for example, to use C: instead of A: and B:, just enter

```
ASSIGN A=C B=C
```

Nor do your reassignments need to be to the same disk drive. If you have two hard disks and two floppy drives, you could use the command

```
ASSIGN A=C B=D
```

You could even reverse the assignments and send C: to A: or D: to B:, though in practical terms this type of assignment seldom makes sense.

The reason you must put all assignments on the same command line is that successive ASSIGN commands supersede previous ones. If you ASSIGN A=C on one line and later ASSIGN B=C, DOS uses drive C: instead of B: but cancels the A=C directive.

While ASSIGN is in effect, you can't use the disk drive that has been rerouted. The activity for the drive is switched to the other drive. If you need to use the ASSIGNED disk drive for any reason, you must cancel ASSIGN. To clear all assignments, just issue the ASSIGN command without using any drive names at all.

FOR FUN AND PROFIT ASSIGN works well with game programs that use additional program or data files. Just copy all the files to a RAMdisk (usually drive E:), make the assignment (ASSIGN A=E, for example), and run the program. If you have an accounting program that knows only drives A: and B:, just copy all its files onto your hard disk (C:)

```
ASSIGN A=C B=C
```

and you'll have a faster-running accounting program running on drive C:.

In addition to having to remember to

cancel your ASSIGNments when you're through with them, there are some inevitable limits to the usefulness of ASSIGN. If you can't get a directory of a diskette, or if you must boot from the diskette (frequently the case with games), then you won't be able to copy the files and ASSIGN can't help you. Again, if you find a program still hitting drive A: occasionally, this is a sign that a copy-protection scheme or direct BIOS call is being used. These programs circumvent DOS, and in doing so they render ASSIGN helpless. Occasionally you may find software that reacts so violently to being reassigned that your machine will lock up or display an exotic error message. The question to be answered in such cases

■ The question is this: If the software can't even be run from a hard disk or RAMdisk with ASSIGN, is it really worth running at all?

is this: If the software can't even be run from a hard or RAMdisk with ASSIGN, is it really worth running at all?

MAKE DIRECTORIES INTO DISKS ASSIGN provides wholesale rerouting of one disk to the current directory of another disk. ASSIGN thus works best when a program fits in one subdirectory or on a RAM-disk. For other cases, SUBST offers more flexibility and control.

The SUBST command, introduced in DOS 3.1 lets a subdirectory masquerade as a disk drive. That is, SUBST lets you assign a disk drive letter (name) for an existing disk drive and subdirectory. The resulting pseudodisk is used like any other disk drive.

To establish the alternate (substitute) name, the command is

```
[d:] [path]SUBST d1: d2:path
```

The first disk drive name, *d1:*, is the letter

designation of any valid drive. It need not be the name of a drive that actually exists in your system: a "logical" drive letter is just as good (and sometimes more convenient) as the name of a drive you physically have. The one proviso, however, is that if you want to use a drive name higher than E: (the highest that DOS normally allows), you must simply include a LASTDRIVE directive in your CONFIG.SYS file. (See the sidebar "The LASTDRIVE Directive.") *d2:path* is a real disk drive (RAM-disks count as real) and *path* is the name of the subdirectory you want to treat as if it were an independent disk drive. After you have issued the SUBST command you will have two ways to access *d2:path*. You can still use its real drive and path name if you want, or you can instead use the alternate disk drive name, *d1:*. For example, to "nickname" the subdirectory C:\BIN as drive E:, the command is

```
SUBST E: C:\BIN
```

Once the alternate name is established, the disk drive name E: is the shortcut name for the subdirectory C:\BIN.

Assuming you have a subdirectory C:\BIN, if you take a directory of it and of E:, you'll find that the directory listings are the same. The only point in which they differ is that DOS will report that one is the directory of C:\BIN and the other is the directory of drive E:, which is exactly what you wanted.

SUBSTITUTIONS remain in effect until canceled (or until you reboot), just as ASSIGNMENTS do. The two commands differ in the way you cancel them, however. Entering ASSIGN with no assignments listed cancels all previous ASSIGNMENTS you have made. Entering SUBST without any arguments does not cancel the command, but rather lets you know what current substitutions are in effect. Assuming the example above, entering

```
SUBST
```

will display the message

```
E: => C:\BIN
```

If any other substitutions are active, they will also be shown, one per line. If no substitutions are active, the DOS prompt simply reappears.

To break a substitution, you use the /D

(disconnect) switch. The command is

```
SUBST d1: /D
```

where *d1:* is the alternate drive name you use with the SUBST command. Thus, to disconnect E: from CABIN, use the following command:

```
SUBST E: /D
```

Most SUBST commands are temporary; you usually cancel the SUBST command after finishing the task that needed SUBST. The common practice is to recycle one or two standard "dummy" drive names. The easiest way to do this is to put the SUBST commands in the batch file that runs the program. For example, if C:\ACCOUNT\DATA, which holds a

program called APPS, is to be used as drive D:, the batch file might be

```
SUBST D: C:\ACCOUNT\DATA
APPS
SUBST D: /D
```

When the batch file is run, the appropriate SUBST command is issued, the application program runs, then the disconnect command frees the letter D:. The batch file "remembers" the right commands. You simply run the right batch file.

SUBST VERSUS ASSIGN SUBST has a number of advantages over ASSIGN. ASSIGN reroutes all activity from one disk to another. SUBST moves the activity for one disk to another disk and subdirec-

tory. SUBST can establish a new logical (alternate) disk drive name; ASSIGN can't. ASSIGN hides the reassigned disk drive. Use a real disk drive as the alternate name, and SUBST also hides the disk drive. However, if you use a logical drive name with SUBST, you can use the subdirectory by its normal name (disk drive and pathname) or by the new disk drive name you've given it.

ASSIGN and SUBST handle directory structures differently. If you ASSIGN A=C:, A's apparent root directory is the root directory of C:. There is no change in the directory structure. SUBST establishes a fresh directory system on the new disk. The real subdirectory becomes the root directory of the new logical disk drive.

This means that with SUBST you can shorten DOS pathnames and get around the 63-character pathname limit. Since DOS sees the SUBSTed subdirectory as the root directory on the new disk, you eliminate having to type in long pathnames or, alternatively, you can start creating a subdirectory structure on the SUBST drive that gives you (if you want it) an effective path length of up to 126 characters.

The DOS manual says that SUBST is preferred to ASSIGN. My personal preference is to use the command that best fits the situation. If all files needed by the program fit within one directory or on the RAMdisk, ASSIGN is my choice. If I don't want to hide a disk drive, or want to use more than one subdirectory, or use a short drive name rather than a long pathname, I prefer SUBST. SUBST works better with programs that know hierarchical directories; ASSIGN with those that don't.

JOIN DISKS JOIN provides another DOS capability in Versions 3.1 and later. SUBST makes two or more disks from one, and JOIN is its complement. JOIN turns two real drives (which, again, may include RAMdisks) into one large "logical" drive with a subdirectory.

The syntax to establish a JOIN is

```
[d:][path]JOIN d1: d2:\directory
```

where *d1:* is the name of the guest disk drive that will be added to another. The recipient or host drive is *d2:*, and *directory* is the name of the host subdirectory.

There are several restrictions on the

THE LASTDRIVE DIRECTIVE

The LASTDRIVE directive was introduced in DOS 2, at the time the CONFIG.SYS file was added. LASTDRIVE tells DOS the maximum number of logical disk drives to recognize as valid for your system. You can have many more logically valid disk drives than you have real disk drives on your computer. Until DOS 3.1 LASTDRIVE had no conspicuous use. With the addition of the SUBST command, LASTDRIVE fills a real need.

By default, DOS allows the use of five disk drive names, A: through E:. If you have one floppy and one hard disk, D: and E: are unused. If you have an additional hard disk or RAMdisks, these letters are taken. In order to get DOS to recognize as valid a disk drive letter beyond E: you must use the LASTDRIVE directive. The line you add to your CONFIG.SYS file is

```
LASTDRIVE = d
```

where *d* is the letter representing the last valid disk drive name you want for your system. Any letter up to Z is allowed, meaning you can have up to 26 "disks" on your computer.

If you plan on using SUBST, having two to five "dummy" disk drives is practical. The letter you give to LASTDRIVE should be two to five letters higher than the last real disk drive (in-

cluding RAMdisks) on your computer.

If you're uncertain how many disk drives are currently being used by your computer, watch your screen after turning the machine on or using Ctrl-Alt-Del. Look for any messages with a disk drive letter. For example, the DOS RAMdisk, VDISK, displays a message like

```
VDISK Version 3.3 virtual disk E:
```

This means that E: is the current highest disk drive. Remember the disk drive name. If you see more than one message, the last disk drive letter shown is the one to remember. If you don't see this type of message, your highest disk drive is B: (no hard disk), C: (one hard disk), or D: (two hard disks).

Add two additional letters to provide for potential SUBST drives. If you end up with E: or lower, you don't need to add a LASTDRIVE directive. DOS has you covered already. If the letter is higher than E:, just add the line LASTDRIVE = d to the CONFIG.SYS file of your startup disk, substituting the drive letter determined in the last step for the *d*. Don't bother adding a colon after the letter; LASTDRIVE doesn't need it.

Now reboot your system so the modified CONFIG.SYS file will take effect, and DOS now has more logical names to use with the SUBST command.

—Chris DeVoney

■ PC LAB NOTES

PHYSICAL VERSUS LOGICAL DISK DRIVES

To understand the commands discussed in this column, you must come to grips with the differences between physical and logical disk drives. A physical disk drive can be touched. A logical disk drive acts like a disk drive, but it may be either another name for a disk drive or it may be only a part of a disk drive.

Most computers today have one or two physical floppy disks and one physical hard disk. The drives may be poked through the front panel of the machine or hidden by the same panel, but they exist as real physical objects.

Logical disk drives are more difficult to understand because the disk drive may or may not be real. Logical disk drives are apparent disk drives. You can store files on the logical disk. You can read files from the logical disk. The logical disk is used like a physical disk drive. To DOS and ourselves, the logical disk looks like a real disk drive.

In order to be able to use logical drives, however, somewhere in the computer there must be a physical item that is being called by the logical disk drive name. The physical item is usually a real disk drive. What this means is that the same real disk drive has different disk drive names.

If you have a single floppy disk drive on your system, you've undoubtedly made use of a logical disk drive, though perhaps without realizing it. Remember when you first typed DIR B: on that system? When DOS told you to insert the diskette for drive B:, you naturally put the diskette in drive A:, the only disk slot you had. On single-floppy-disk systems, DOS establishes two logical disk drives (A: and B:) from the single physical disk drive.

The "two-drive-in-one" concept helps copying files between diskettes. DOS interrupts and waits for us to change diskettes before starting the activity for the "other" drive. Physically, you have one disk drive. Only our programs and our perception of the disk drive are

changed. For our purposes, we now have two disk drives.

Another "two-drive-in-one" trick is used with hard disks that hold more than 32 megabytes. DOS can't cope with more than 32MB disk drives without performing a bit of chicanery. The single physical disk must be partitioned (subdivided) into several smaller disk drives. Each partition gets a logical disk drive name. The 40MB disk drive of the PS/2 can be broken into two disk drives. One partition can be 32MB and the second partition 8MB, or two equal-sized partitions of 20MB each can be used. DOS 3.3 sees each partition as a separate disk drive, usually drives C: and D:. Same

■ When you partition a hard disk, you create logical "walls" that separate a single hard disk into several disk drives.

hard disk, just several different names.

There is a subtle difference between these two examples. The different logical names for the floppy disk drive refer to the same physical drive. A: and B: are the same real disk drive. You might change the diskette when using the "other" floppy disk drive, but you use the whole diskette that is in the disk drive. Change diskettes and you get different files. Don't change diskettes and you get the same files.

The different logical names for the hard disk refer to different physical areas on the hard disk. When you partition a hard disk, you create logical "walls" that separate a single hard disk into several disk drives. The same disk drive elec-

tronics and recording heads store the information on the entire hard disk. But the area on the hard disk for drive C: is different than the area for drive D:. You cannot get the information "stored" for drive C: using D:, nor can D: access the information "stored" on drive C:.

For the floppy disk, two names can mean the same diskette and the same files. For hard disk partitions, the two names always mean different areas on the disk and different files.

However, we can establish and use additional names for the same disk drive. We can also establish and use additional drive names for a portion of a disk. You create a logical disk drive name. To DOS and ourselves, the logical disk drive is just another disk drive. However, the disk drive is only a subdirectory of another disk. This is the purpose of the SUBST command. DOS is casual about logical disk drive names. The result is that we can control the additional logical names for any disk, or use a disk drive name for any subdirectory of a disk.

RAMdisks, which fall into the nebulous category of semireal physical disks, should be mentioned. RAMdisks are "apparent" disks that use RAM as if the RAM were a real disk drive. The RAM physically exists; we just use the RAM like a disk drive. Since the files written to the RAMdisk physically reside in the memory chips which make up the RAMdisk, for this discussion RAMdisks are classified as real disks whose only oddity is the fact that they get erased when you turn the power off.

Thus, all logical disk drives are connected to a physical device. The device can be a real floppy disk, a real hard disk, a partition of a hard disk, a subdirectory of a disk, or RAM. DOS controls some logical names, such as B: on the single-floppy computer or D: for a "second" hard disk. However, other logical names are under our control. Logical disk drives give us a convenient way to use our disks and RAM in awkward situations.

—Chris DeVoney

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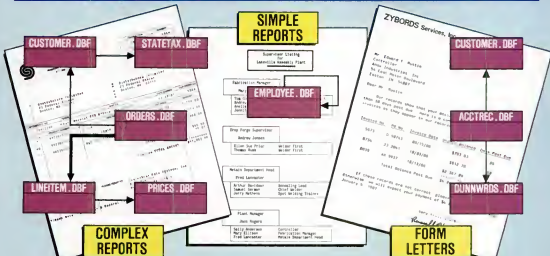
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■ PC LAB NOTES

host directory. First, it must be a "level one" subdirectory, which means that it is directly under ("owned by") the root directory. Second, it must be empty: no files and no other subdirectories except the "... and ..." entries are allowed in it when JOIN takes effect. Third, the host subdirectory can't be either the current directory or the root directory. After the JOIN, however, the host directory can be made the current directory.

Given these restrictions, fortunately, directory may be a nonexistent subdirectory at the time you enter JOIN. JOIN creates a path if the subdirectory does not exist. Note, however, that JOIN does not remove the subdirectory after you later disconnect the joining. If you wish to delete the subdirectory after JOIN has been canceled, you must use the RMDIR command.

To see how JOIN works, put a diskette into drive A: and move to the root directory of your hard disk (C:). Take a DIR of the floppy disk and then of the fixed disk. Then type the command

```
JOIN A: C:\ADRIIVE
```

Drive A: is now joined to drive C: through the (newly created) ADRIIVE subdirectory. To see the effects of the JOIN, enter the following DIR commands:

```
DIR
DIR ADRIIVE
DIR A:
```

The first listing will show the root directory of your fixed disk, and you'll see that a new subdirectory called ADRIIVE has been added. The second listing shows the files on the diskette. Notice that the "displayed" directory, according to DIR, is C:\ADRIIVE. This is how DOS now views drive A:, namely, as a subdirectory of C:. The last DIR should produce an invalid drive specification error. While the guest drive is part of a JOIN command, you can't access the drive by its normal name. You must use its new subdirectory name.

The JOINed disk drive is "logically" a part of the host's directory structure (see the diagram "JOIN: Before and After"). The directory tree of A: is unplugged at the root and transplanted into \ADRIIVE. Subdirectories of A:\ are now subdirectories of

C:\ADRIIVE. For example, if the diskette had a subdirectory called COMS, the only way to get its directory listing would now be with the command

```
DIR ADRIIVE\COMS
```

You must use the pathname. While the

■ While the guest drive is part of a JOIN command, you can't access the drive by its normal name. You must use its new subdirectory name.

JOIN is in effect, A: has disappeared.

Like SUBST, JOIN can show the current joinings of disks. Simply type the JOIN command without arguments. If you type JOIN after joining A: to C:, you should see

```
A: => C:\ADRIIVE
```

If no joins are active, nothing is displayed and the DOS prompt reappears.

To disconnect a joining, the /D switch is used. The syntax is identical to that for SUBST:

```
JOIN d1: /D
```

where d1: is the letter name of the guest disk drive. JOIN breaks the connection between the host and guest disk drives. The guest disk drive can be used normally. To break the joining of A: from C:, use the command

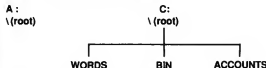
```
JOIN A: /D
```

The most popular use for JOIN is to connect a RAMdisk to a hard disk. You can also JOIN a floppy disk to a hard disk. Some "sweep" programs automatically search subdirectories for files. Joining a RAM or floppy disk to a hard disk allows the programs to automatically find and use the files on the other disks. In terms of my own work, while I find ample use for ASSIGN and SUBST, I rarely have an application that requires the JOIN command.

A FEW PRECAUTIONS When you use ASSIGN, SUBST, or JOIN, DOS alters its view of real and semireal disks. You might use logical drive names to access the disks, but of course the real action takes place on real and semireal disks. Forgetting the difference can lead to surprises. For these reasons, some DOS commands

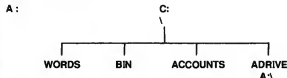
JOIN: Before and After

Directory structure before JOIN command

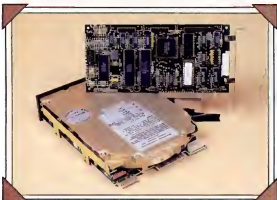


Directory structure after JOIN command

```
JOIN A: C:\ADRIIVE
```



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■ PC LAB NOTES

USING SUBST WITH WORDSTAR

To show how SUBST can work with programs that cannot switch directories, I'll use *WordStar*, Version 3.3, as an example. *WordStar* 3 is typical of programs that have additional files that must be kept in the current directory.

The methods shown here can be applied to any program that: (1) is ignorant of subdirectories, (2) can use any disk drive and, (3) can be run from any disk drive. The third part means there must be an installation program to tell the program which disk drive holds the auxiliary files. *WordStar* 3 qualifies on three counts. (*WordStar* 4 knows about hierarchical directories and doesn't need this SUBST trickery.)

I'll present two basic procedures. The first procedure uses SUBST to make disk drives from the subdirectories that hold our documents. We run from the directory holding *WordStar* and edit documents anywhere. The second procedure uses SUBST to establish a dummy disk drive for *WordStar*. We can edit documents in our current directory by running *WordStar* from anywhere.

For these examples, we'll make several assumptions. We'll establish separate directories for our documents, such as directories for letters, contracts, memos, and articles. The subdirectories are owned by C:\WORDS. *WordStar* normally runs from C: (you've used WINSTALL for this) and the *WordStar* program files have been copied to C:\WORDS\WS. The layout of the subdirectories for the documents is illustrated in the diagram "Word Processing

Subdirectories." The last assumption is that the LASTDRIVE command was given so that the disk drive name F: is valid. (See the sidebar "The LASTDRIVE Directive.")

METHOD ONE With our first procedure, we run from the *WordStar* directory and can edit files in any directory. The trick involves using SUBST to fool *WordStar* into thinking the subdirectory is drive F:.

For example, we wish to edit a file in the LETTERS subdirectory. The steps are (1) move to the *WordStar* directory, (2) issue SUBST to make LETTERS logical disk drive F:, (3) make F: our current disk drive, (4) run *WordStar*, (5) switch back to C:, and (6) break the substitution. The commands, which are perfect for a batch file, are

```
CD C:\WORDS\WS
SUBST F: C:\WORDS\LETTERS
F:
C:WS
C:
SUBST F: /D
```

The lines in the batch file follow the steps above. We change to the *WordStar* directory. SUBST is used to make the dummy disk drive F: from the LETTERS subdirectory. We switch to F: I use this procedure so I don't have to give a disk drive name for every document I want to edit. Then we run *WordStar*.

After we exit *WordStar*, the rest of the batch file is executed. We switch back to C:, then free up (disconnect) F: so the

dummy drive letter can be used again.

You could have a separate batch file for each document subdirectory, such as LETTERS.BAT, CONTRACT.BAT, MEMOS.BAT, and ARTICLES.BAT. You simply edit the second line of the batch file and change the subdirectory name. For example, the second line in the MEMOS.BAT file would be

```
SUBST F: C:\WORDS\MEMOS
```

If you put these batch files in a subdirectory given to the PATH command, you can run them from any disk or subdirectory. If you added any subdirectory for documents, add a new batch file making the change in the second line.

An alternative approach to the same procedure is to combine these batch files

■ SUBST can work with programs that cannot switch directories, such as *WordStar*, Version 3.3.

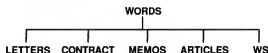
into one. The listing for the appropriate batch file is presented in Figure A. Put this batch file in a PATHed directory. To run *WordStar*, you simply type WS followed by the subdirectory holding the files you wish to edit. For example, to edit documents in the MEMOS subdirectory, the command would be

```
WS MEMOS
```

The batch file does the hard work of switching disks and directories, issuing the right SUBST command, and doing the cleanup work after leaving *WordStar*.

When adding new document subdirectories or deleting old subdirectories, change the names in the FOR . IN . DO statement in the third line. Notice I've used upper- and lowercase names. The reason is that DOS is very literal with its

Word Processing Subdirectories



A sample directory structure for *WordStar*, Version 3.3, and documents.

```

echo off
if %1. == . goto mistake1
for %d in (LETTERS, lettera, CONTRACT, contract, MEMOS, memoa, ARTICLES,
article) do if %d == %1 goto hit
goto mistake2
:hit
cd c:\words\wa
subat f: c:\words\%1
f:
ws
subat f: /d
c:
goto end
:mistake1
echo I could not find a document type.
echo Please try again specifying which document type we wish to edit.
goto end
:mistake2
echo I do not have a document type of %1.
echo Please try again specifying one of these document types:
echo LETTERS CONTRACT MEMOS ARTICLES
:end

```

Figure A: Listing of WS.BAT.

IF test. If I used only uppercase names and the user typed a lowercase name, the test would fail. The third line may be difficult to maintain, but the user won't want to punch your keys out if his Shift key was wrong.

The all-in-one batch file approach is more disk efficient (less wasted disk space) than using separate batch files. However, big batch files are slow. Given a choice, I prefer the separate batch file approach. The small batch files are easier to maintain and run quicker.

METHOD TWO The method I prefer is to make *WordStar* use the directory that holds *WordStar*. I trick *WordStar* into thinking it should run from drive F:. I then can move to any subdirectory and call up *WordStar*. To use this method, you must use *WINSTALL* to change *WordStar*. Also, you cannot use *WordStar* without giving a *SUBST* command beforehand. While this method has more "brute force" than the first, the result is actually simpler to use than the previous batch file approaches.

The real trick is telling *WordStar* that F: is its system disk. The system disk is where *WordStar* searches for its auxiliary files. The *WordStar* installation pro-

gram, *WINSTALL*, makes this task fairly painless.

First, run *WINSTALL*. You'll wade through several screens. Answer the questions that lead to the first main menu—the one that mentions terminals, printers, and "Menu of *WordStar* Features," option E. Choose option E.

When the menu of *WordStar* features appears, choose option R, to change the "System disk drive." *WordStar* presents the current choice, then asks you to type C if you wish to change this value. Type "C".

Now *WordStar* wants a number for a disk drive. A: is 1, B: is 2, C: is 3, and so on. Drive F: is number 6. Type 6. Type X to go back to the main menu and type X again to exit the main menu. When *WordStar* presents the options to get out, try again, or save the changes, type A to save the changes. *WordStar* is now altered to use F: for its files.

The next step is to use the *SUBST* command to make the subdirectory that *WordStar* is using into a disk drive. The command is

```
SUBST F: C:\WORDS\WS
```

When *WordStar* looks for its files on F:, the system disk, DOS tricks *WordStar*

into using C:\WORDS\WS. *WordStar* remains fooled and finds its files.

If you use *SUBST* only with *WordStar*, you can use the batch file shown in Figure B. Put this batch file in a *PATH*ed directory. Then, to use *WordStar*, move to the directory holding the documents you want to edit and issue the command

WS filename.ext

where *filename.ext* is the name of the document you want to edit. The batch file passes this name to *WordStar*. If you give a filename on the command line when running *WordStar*, *WordStar* skips the main menu and immediately enters the editing mode. If you don't give the filename, *WordStar* slips into the main menu.

When *WordStar* exits, the batch file continues. F: gets disconnected from C:\WORDS\WS. This allows F: to be used again by another *SUBST* command.

If you use *WordStar* frequently or use *SUBST* with more than one program,

```

SUBST F: C:\WORDS\WS
C:\WORDS\WS %1
SUBST F: /D

```

Figure B: Listing of WS.BAT using an "altered" *WordStar*.

you should make *SUBST* a permanent part of your setup. Put the *LASTDRIVE* directive in your *CONFIG.SYS* file to give three or five dummy disk drive letters. Install the highest logical drive name in *WordStar* and use the same drive letter in your *SUBST* command. For example, if J is the highest drive name, install J into *WordStar* (drive number 10 for *WINSTALL*) and put the command

```
SUBST J: C:\WORDS\WS
```

in your *AUTOEXEC.BAT* file. When the computer is started, the *SUBST* command is activated and *WordStar* can be run from any disk drive.

—Chris DeVoney

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■ PC LAB NOTES

should be used with caution, and some should be avoided altogether with drives that are part of an ASSIGN, SUBST, or JOIN command. In most cases, DOS stops you from shooting yourself in the foot, but not always.

The following DOS commands should not be used on the disk drives involved in an ASSIGN, SUBST, or JOIN command:

DISKCOPY	FORMAT
DISKCOMP	BACKUP
FDISK	RESTORE

Most of these commands immediately issue an error message when used with an ASSIGNed, SUBSTituted, or JOINed drive. The reason is that you may inadvertently operate on a drive that is different than the one you specified. This is dangerous with DISKCOPY, FDISK, and FORMAT, which will destroy information you had no intention of losing. I know, indeed, of one case where a clone-user had issued an ASSIGN command to redirect the floppy to the hard disk. He later tried to format the floppy disk. The hard disk was formatted instead. This happened with a version of DOS 2.1. I don't know of any case where DOS 3 acted this way, but I emphatically don't wish to find out the hard way.

DIR and CHKDSK commands may give misleading responses or may not work at all. DIR lists the files on the assigned-to-disk drive, not those of the assigned drive. You can't get a DIR from the ASSIGNed drive until you cancel ASSIGN.

You can use DIR on a SUBSTituted disk. DIR displays a proper list of files. The drive and directory name given reflects the rerouting. However, the volume label is from the real disk drive.

You can use DIR directly on the guest drive in a JOIN command, but not by its real drive name. To get that directory listing, either break the JOIN first or give DIR the new subdirectory name. Note that DIR reports the proper statistics for displayed files, but the free disk space shown is for the host disk drive only.

CHKDSK refuses to work on the rerouted disk drive in the ASSIGN or JOIN command. CHKDSK won't work on a SUBSTituted disk drive (which is actually a directory). To use CHKDSK on the subdirectory, use the real subdirectory name

and not the alternate drive name.

CHKDSK processes the host disk drive of a JOIN command, but skips the guest "disk." Like DIR, CHKDSK shows the free disk space on the "real" disk drive only. To find the real free space for the other drive, break the SUBST or JOIN.

DOS can't stop you from shooting yourself in the foot with LABEL, CHDIR, MKDIR, or RMDIR. Although you specify one disk drive, DOS actually uses an-

■ I know of one clone user who issued an ASSIGN command to redirect the floppy to the hard disk. He later tried to format the floppy. The hard disk was formatted instead.

other disk drive. For example, if you use LABEL on an ASSIGNed, SUBSTituted, or JOINed disk drive, it's the "real" disk drive that gets labeled. The directories you change, create, and remove are on the physical disk drive involved in the rerouting. Keep in mind what disk is actually being affected by these commands.

As a good rule of thumb, be sure that you don't end up hiding your "work-horse" drive. If you do, DOS will not be able to find programs along the PATH or data files in the APPEND (DOS 3.3) directories. For example, suppose that drive C: is the drive holding DOS and your application programs. Using the command

SUBST C: D:\TEST

reroutes the activity for C: to D:\TEST. When DOS attempts to find any programs, it is rerouted. But D:\TEST probably does not have an identical set of subdirectories nor does it have the programs of C:. The result is you will not be able to find or run most programs. You won't be able to cancel the SUBST command without a floppy disk-based copy of DOS. The SUBST

command is also hidden with the rest of the programs on C:. The same caveat applies to the ASSIGN command.

Redirecting BACKUP, DISKCOMP, and RESTORE can be annoying or even frustrating. DISKCOMP is usually used with DISKCOPY. You must break any redirection of the floppy disk before using DISKCOPY. Losing the ability to DISKCOMP an ASSIGNed or JOINed drive is no problem. However, using BACKUP and RESTORE while JOIN is in effect can produce problems. BACKUP follows the logical structure of the disk, which includes the JOINed disk. Thus, you back up more files than you wish. The real problem comes when you run RESTORE, which attempts to restore files where the logical disks or directories no longer exist. The result is seldom desirable.

One final caution concerns PRINT. Like a number of programs (especially those with copy protection), PRINT has an allergic reaction to ASSIGN. You can't use the two together. Be careful when SUBSTituting and JOINing a disk with PRINT. PRINT may not be able to find the files to send to the printer.

If you need to use any of these DOS commands, first break the assignment, joining, or substitution. Then run the commands. This practice prevents frustration.

Finally, do not mix the ASSIGN, SUBST, and JOIN commands so that you reroute rerouting. You can JOIN a disk drive, perform a SUBSTitution on the JOINed directory, and then use ASSIGN to direct the whole thing to a different disk drive. DOS happily reroutes the disk activity. But where the rerouted activity ultimately goes may be difficult for you to determine.

IN SUM ASSIGN, SUBST, and JOIN are powerful advanced commands. They can be difficult to learn and, as the warnings above have shown, their use is subject to several pitfalls. However, properly used, these commands can help prolong the life of useful, if old, programs by bridging the gap to the modern world of hard disks and RAMdisks.

Chris DeVoney is an Indianapolis-based writer and author of five computer books including Using PC-DOS.

Quick Paint

Security

"Quick painting method when the dictionary is already

Relations

Indexing

Set Video

Key Disable

Invoice Entry Window

INVOICE.NO
INVOICE.DATE
CUSTOMER.NO

Qty	Prod.
####	#####
####	#####
####	#####

Comments #####
#####

= = = =

Advanced
Revelation
Prompt Options

Option
1>Prompt Window
2 Remove Prompt
3 Drag Prompt
4 Reorder Prompts
5 Edit Dictionary
6 Edit Help Record
7 Hide Settings

#####

#####

= = =

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CAPTURING YOUR PRINTER OUTPUT



PRN2FILE lets you capture the printer output from programs and such DOS commands as Ctrl-PrtSc and Shift-PrtSc into a file you can edit with your word processor.

While there's no substitute for the hard-copy printout you can put on the boss's desk, there are times when you'd like to print to a file instead. If you have an important letter ready to go but the office laser printer is attached to another machine, the sensible thing would be to spool your document onto disk, then take it over to the other machine and print it later. Although some of the more sophisticated word processors allow you to redirect printer output to a file, most don't.

Again, while the DOS Ctrl-PrtSc command lets you echo your output to a printer, and Shift-PrtSc does the same for a screenful, neither of these lets you save that printer output to a file that you can edit with your word processor before printing.

That's exactly what PRN2FILE does. PRN2FILE is a resident program that lets you redirect printer output to a file of your choice. The most logical way to load it is through your AUTOEXEC.BAT file; in any event, it should be installed before any other print utilities, such as the DOS MODE command or a print spooler. The complete syntax is

```
PRN2FILE [dr][path]filename [/Pn] [/Bn] [/U]
```

You specify the *filename* to which you want your printer output redirected. If you omit the drive and path, the current drive and directory will be used. Successive "print" tasks will be appended to the same file unless you choose to change the *filename*. You can change it, or disable redirection entirely, simply by running PRN2FILE again. Each successive time,

the current target file for redirection is displayed. To deactivate redirection, just omit the filename completely. Your printer can then be used normally. When redirection is turned off, the filename PRN is shown, indicating that the real printer is being used.

Three optional parameters are used to indicate the printer number (/Pn), to specify the buffer size (/Bn) in kilobytes, and to uninstall (/U) the program. These optional switches may be entered in any order, but you must use single spaces and not any of the other common delimiters (commas, et al.) to separate the options.

The /P parameter is used to indicate the number of the printer you want redirected. You may specify a value from 1 to 3. In most cases, the default value of 1 (DOS uses LPT1 exclusively) should suffice. If you have multiple printers, however, you can specify which one you would like to have redirected and then use the other nor-

mally. You can even use PRN2FILE to redirect printer output to a fictitious printer, by specifying /P2 when you have only one printer attached, for example. Only one printer is redirected at a time. However, you can change which one is redirected by again typing PRN2FILE with the new parameter.

Buffer size is specified with the /B option. This option can be specified only the very first time PRN2FILE is run; it is ignored on successive runs. For most requirements, the default of 4K is quite adequate, but if you're going to be doing some heavy-duty printing, a larger buffer may be needed. (If the buffer isn't big enough, the message "Buffer Overflow" will appear in your output file.) It may take some experimentation to determine the required size. As a general rule, specify the largest file you will print. Using a buffer larger than necessary wastes memory, but if you've got memory to burn, go ahead with the maximum of 64K. Any documents larger than that are always broken down internally into chunks of 64K or less.

The Uninstall option (/U) allows you to remove PRN2FILE from memory. With its standard buffer size, PRN2FILE commandeers about 5.9K of RAM. Since most modern machines sport 640K or more, this should present no problem. If any other resident programs were installed after PRN2FILE, however, the uninstall may not be successful. You could end up with an island of free memory that is essentially useless for running other programs. (After loading your favorite utilities, you can run PCMAP [in our PC Lab Notes, Volume 6

■ You can even use PRN2FILE to redirect printer output to a fictitious printer, by specifying /P2 when you have only one printer.

■ UTILITIES

Number 14—Ed.] to determine the amount of memory remaining for applications programs.) Further, if another program chains into it, PRN2FILE can't be released at all. The Uninstall routine detects such problems and prints an error message if all is not well, but in any case, no harm is done. When /U is being used, any other parameters are ignored.

Once installed, PRN2FILE waits for data to be sent to the printer. Each character aimed at the printer is inserted into an internal buffer, and as the buffer fills its contents are written to the file. Because of this, you'll notice the file remains empty until at least 1,024 characters are accumulated. The buffer is then emptied and the process continues. The buffer is also flushed automatically 5 seconds after the last character is printed. If for some reason

you think some of your output is still in the buffer, running PRN2FILE again ensures that the buffer will be flushed to disk. This delayed flushing of the buffer may seem strange, but it's due to the character nature of the printer. I'll discuss this further below, when discussing the way printers work. In practice it shouldn't be a problem as long as you recognize it as a normal procedure.

If you edit a file of data that was meant for the printer, you may notice strings of odd-looking characters that are not part of the text. These codes are used to control the printer and are normally not seen. Word processors are notorious for using these escape codes to access printer features such as compressed mode, emphasized type, or margin settings. If you intend to print the file later, you should leave

them unchanged, even if they make the file hard to read.

PRN2FILE does have a couple of limitations you should be aware of. The most troublesome problem manifests itself only when large quantities of data are dumped to the printer at once. If the buffer used to spool your printed output is not large enough, an overflow occurs. The solution is to use the /B option to create a larger buffer, then try again.

Another caution about disk errors is in order. PRN2FILE is programmed to ignore errors such as a full disk or bad media. To implement a complete error recovery scheme is beyond the scope of this utility. In the event of an error, the buffer contents are lost without warning. So if your file doesn't appear as expected, be sure to check the disk first.

```

;-----
; PRN2FILE.ASM -- A resident program which redirects printer output.
;
; SYNTAX: PRN2FILE [path]filename.ext [/Pn] [/Mn] [/U]
;
; 1) Run PRN2FILE with the desired filename to activate it.
; 2) Run it again with no filename to turn off redirection.
; 3) Run it with a different filename to change destination file.
; 4) Use /P to designate the printer number (defaults to 1).
; 5) Use /M to enter buffer size in K bytes (defaults to 4).
; 6) Use /U to uninstall the program.
;-----
CODE SEGMENT
ASSUME DS:CODE, DS:NOTHING

START:    ORG 1000H ;beginning for .COM program
          JMP INITIALISE ;initialization code is at end

;-----
; Data area used by this program
;-----
COUNTER    DB 0
PROGRAMMER DB "Tom Ikhle"
REDIRECT_MSG DB "LPT"
PRN_NUM    DB 1 ;redirected to ?
BAD_FILENAME DB "Invalid filename."
BAD_PARAM  DB "Usage: PRN2FILE [path]filename[/Pn[/Mn[/U]]]"
BAD_ALLOC  DB "Memory Allocation Error."
BAD_UNINSTALL DB "Cannot Uninstall."
PRN_TXT    DB "PRN"
CHKP      DB 13,10,""
ERR_MESSAGE DB 13,10,"Buffer overflow",13,10
MSG_LBLNTH EQU 8
CLOCKTMR   DB 0
CLOCKINT0  DB 0
CLOCKINT1  DB 0
CLOCKINT2  DB 0
DUE_FLAG   DB 0
SWITCH     DB 0
TIMEOUT    DW 0
INSTALLED EQU 0
WRITE_FLAG DB 0
PRINTERS EQU 0
BUFF_POINTER EQU 0
BUFF_SIZE  DW 0
BUFF_SEGMENT EQU 0
TIME_TO_WRITE EQU 0

;-----
; Interrupt 17 routine. (BIOS printer output)
; If output is to the selected printer and switch is on then redirect
; the character into a file.
;-----
REWINIT17 PROC FAR
ASSUME DS:NOTHING, ES:NOTHING

CMP DX,CH.PRINTER_NUM ;Is this the selected printer?
JNE IGNORE ;If not, let bios handle it
CMP CH,INTERRUPT_1 ;Is redirection turned on?
JE REDIRECT_17 ;If on, take jump

IGNORE:    JMP 0 ;Jump to the bios routine

REDIRECT_17:
;-----
; New interrupt 8h (timer tick) decrement the timeout counter. Set
; the flush flag when counter reaches zero.
;-----
REWINIT8 PROC FAR
ASSUME DS:NOTHING, ES:NOTHING

PUSHBP
CALL CH.CLOCKINT0 ;simulate an interrupt
DEC CH.CLOCKTMR ;count down the flush time count
JNE JUMP_17 ;count until it gets to zero
CMP CH,INTERRUPT_8 ;Is interrupt in buffer?
JNE JUMP_17 ;If not, just continue
JMP 0 ;flush buffer

JUMP_17:
;-----
; Interrupt 21 routine. (DOS function calls) interrupt function 4ah
; when it writes to the printer. Also check to see if WRITE_FLAG is
; set to one. If it is then flush the buffer.
;-----
REWINIT21 PROC FAR
;-----

```

(continues)

```

2 Replace the dos device error interrupt with our own routine.

MOV     DS,OFFSET MEMINT24
MOV     AX,2524h      ;Setup to change int 24h vector
CALL    DOS_FUNCTION  ;do the dos function

2 First try to open the file. If dos returns with the carry flag set,
; the file didn't exist and we must create it. Once the file is opened,
; advance the file pointer to the end of the file to append.

CMP     RDI,POINT,8    ;Anything in the buffer?
JE      REF_VECTOR     ;No ref. no nothing
MOV     SI,OFFSET FILENAME ;Point to filename
MOV     AX,3024h       ;do function to open file
CALL    DOS_FUNCTION   ;do the dos function

```

```

DOS_FUNCTION      EINTF
;
; New interrupt 2Ah (critical dos error). This interrupt is only in
; effect when writing to the disk. It is required to suppress the
; "Abort, Retry, Ignore" message. All fatal disk errors are ignored.
;
KEMINT24          PROC        FAR
    ASSUME        DS:NOTHING, ES:NOTHING

    STI
    XOR           AX,AX
    CS:PTRXFER,AX
    IRET

;Purp Interrupts back on
;Tells dos to ignore the error
;Turns off looping of output
;And return to dos

PEMINT24          ENDP
;
; New interrupt 2Bh (good idle). Check to see if write flag is set to
; 0. If it is, then flush the buffer
;
NEWINT2B          PROC        FAR
    ASSUME        DS:NOTHING, ES:NOTHING

    STI
    CMTPI        CS:WRITE_FLAG, 0 ;buffer need to be written?
    JF            CS:WRITE_FLAG    ;if not, just continue
    CALL         WRITE_TO_FILE    ;empty the buffer

DOS_NOTHING:      JMP         CS:OLDINT2B ;continue with old interrupt

NEWINT2B          ENDP

```


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Symphony	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Framework	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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■ UTILITIES

GETTING PRN2FILE Both the assembler source code and a BASIC program that will create PRN2FILE.COM are listed elsewhere in this article (see PRN2FILE.ASM and PRN2FILE.BAS). As an alternative to keyboard entry, both of these files and a complete, ready-to-run PRN2FILE.COM file are available for download from the PC Magazine Interactive Reader Service, as explained in the sidebar "PRN2FILE by Modem."

Before looking at how redirection works, let's see how programs normally use the printer. Most of us are already familiar with higher-level commands such as the DOS PRINT command. But we need to look at the more fundamental operation of the device.

A printer may be addressed at any of three levels, which I'll call machine, BIOS, and DOS. Exactly which method is used by any particular program is difficult to determine, though typically programs that use the highest level (DOS) are the most versatile and well behaved. The lower levels are used when maximum speed is required, even at the sacrifice of compatibility. PRN2FILE can redirect output at either the BIOS or DOS level, but any output done at the machine level can't be redirected. Detecting printer output at the machine-code level would require special hardware to intercept the I/O requests. Now let's see how each of these methods works.

MACHINE-LEVEL PRINTING At the lowest level, simple machine instructions (such as IN and OUT) are used. These powerful commands directly control the electrical signals that are applied to the pins of the parallel port interface. A series of 8 data bits and a handful of control signals are used to communicate directly with the printer.

To transmit a character, you first wait until the printer indicates that it's ready to receive data. You do this by using an IN instruction to read the printer status from pin 11. When a not-busy signal is received, the data can be placed on the data lines with the OUT instruction. Next, a strobe signal is sent, which instructs the printer to read the byte. The strobe is generated by setting pin 1 high, then immediately resetting it low.

Writing this type of hardware device driver is not for the faint hearted. Critical timing rules must be followed precisely. Furthermore, when addressing ports directly, you must contend with the differences among the various types of hardware available. Because of these limitations, few programs elect to use this method. Besides, the code required to access the printer is readily available in BIOS.

PRINTING BY BIOS Using the computer's Basic Input/Output System (BIOS) is the next step up in ease of use. The BIOS is a set of procedures contained in read-only memory (ROM) that handle the details of dealing with touchy hardware. The standard IBM-PC BIOS includes support for the keyboard, floppy disks, display, printer, and a few other devices. Using BIOS is easy. It's completely documented in the IBM *Technical Reference* manual, which even provides the BIOS source code. Studying it thoroughly will give you a full understanding of the internal workings of your PC (as well as a case of permanently crossed eyes).

The BIOS services are all accessed with software interrupts. Interrupt 17h is used for printer control. The following three functions are provided:

- Function 0 Print a character
- Function 1 Reset the printer
- Function 2 Obtain the printer status

To print a character using the BIOS, you put the data in register AL and a zero in AH, and then issue interrupt 17h. It seems so easy you'd think it would be the method of choice. Many programs do in fact issue BIOS calls directly. As long as—but only as long as—the computer has an "IBM compatible" BIOS, this technique works fine. But the most sophisticated way to print is to use DOS.

PRINTING WITH DOS SERVICES DOS provides printing services similar to the BIOS. The advantage to using DOS is that it provides device-independent printer functions. This means that a DOS print function will work on any DOS machine. Other advantages include the ability to print entire strings rather than a single character. DOS also processes errors with the familiar "Abort, Retry, Ignore" message. DOS functions are requested with

software interrupt 21h. There are two print functions available. Function 5 is used when a single character is to be printed. Function 40h is the "write to device" function and can print up to 64K bytes of text at a slug. When using this function to write to the printer, the handle is set to 4, i.e., to the predefined DOS print device.

I've several times mentioned printing one character at a time. Printers are "character devices," i.e., they are capable of processing only one byte at a time. To print an entire page requires separately printing letter after letter. If you think about that the next time you print a lengthy report, you'll begin to appreciate the amount of work your computer does for you.

Disk drives, on the other hand, are "block devices." They handle data in chunks. (DOS uses a block size of 512 bytes.) This is an important factor for PRN2FILE, since it must take data from a character device and send it to a block device.

THE BUFFER Gathering up a block of data is a natural job for a buffer. Buffers are used extensively in systems programming as a temporary holding area for data. They come in all sizes and shapes (such as straight and circular). The buffer used by PRN2FILE is a simple straight buffer with a capacity of 4,096 bytes (or as specified by /B). The buffer is a segment of computer memory that temporarily holds characters waiting to be written to the disk. The pointer `BUFF_POINTER` is used to hold the location of the next empty position. Each byte that is to be printed is entered in the buffer, where it remains until enough are gathered to warrant a disk write. Then the entire buffer is written to the file with a single command. If each byte were written to the disk by itself, an intolerably high number of disk accesses would result.

Determining the buffer size for a program such as PRN2FILE is always a trade-off. On the one hand, the smaller you make it, the quicker it fills and requires disk accesses. Making it larger, on the other hand, consumes memory that is then unavailable for other programs. Resident programs should always use as little memory as possible.

Next to size, the most important factor to consider concerns the way the buffer is

■ UTILITIES

1100 DATA	46,	231,	1,	106,	3,	1,	232,	158,	856
1110 DATA	1,	247,	22,	8,	1,	51,	219,	140,	681
1120 DATA	280,	67,	59,	195,	142,	195,	118,	68,	1814
1130 DATA	190,	8,	1,	139,	254,	185,	146,	8,	785
1140 DATA	243,	146,	11,	240,	117,	235,	38,	198,	1209
1150 DATA	6,	239,	5,	1,	38,	139,	22,	245,	691
1160 DATA	5,	137,	22,	265,	1,	109,	1,	285,	792
1170 DATA	23,	128,	194,	49,	136,	22,	64,	1,	817
1180 DATA	149,	6,	242,	1,	14,	7,	138,	82,	648
1190 DATA	88,	8,	8,	118,	99,	178,	47,	232,	758
1200 DATA	59,	1,	242,	174,	227,	188,	139,	5,	990
1210 DATA	199,	49,	255,	32,	32,	32,	68,	891	1086
1220 DATA	112,	116,	55,	68,	98,	116,	13,	68,	638
1230 DATA	117,	116,	6,	196,	188,	5,	232,	4,	763
1240 DATA	5,	232,	289,	1,	199,	6,	249,	5,	938
1250 DATA	8,	8,	161,	249,	1,	179,	18,	246,	846
1260 DATA	227,	73,	128,	29,	128,	235,	48,	114,	990
1270 DATA	198,	128,	251,	9,	119,	192,	198,	5,	1897
1280 DATA	32,	58,	255,	3,	195,	183,	249,	1,	948
1290 DATA	235,	224,	71,	138,	5,	198,	5,	32,	980
1300 DATA	142,	64,	1,	44,	49,	58,	238,	68,	658
1310 DATA	3,	115,	192,	183,	245,	5,	235,	157,	1111
1320 DATA	146,	45,	1,	188,	9,	285,	33,	186,	861
1330 DATA	191,	1,	232,	232,	8,	176,	8,	232,	1865
1340 DATA	289,	8,	131,	62,	249,	1,	114,	767	1818
1350 DATA	142,	135,	62,	249,	1,	64,	119,	155,	943
1360 DATA	176,	32,	232,	228,	8,	242,	174,	227,	1384
1370 DATA	255,	128,	61,	58,	117,	18,	79,	138,	888
1380 DATA	9,	139,	5,	32,	32,	235,	144,	858	1818
1390 DATA	188,	25,	285,	33,	4,	65,	188,	58,	758
1400 DATA	142,	186,	6,	176,	92,	162,	148,	6,	819
1410 DATA	232,	182,	8,	242,	176,	237,	6,	197,	1214
1420 DATA	188,	6,	235,	37,	144,	138,	22,	188,	798
1430 DATA	6,	128,	224,	223,	128,	234,	64,	198,	1159
1440 DATA	188,	6,	139,	254,	188,	71,	325,	33,	997
1450 DATA	114,	88,	176,	8,	58,	5,	118,	5,	544
1460 DATA	185,	64,	8,	242,	174,	198,	69,	255,	1187
1470 DATA	92,	87,	116,	32,	232,	138,	8,	243,	932
1480 DATA	176,	176,	176,	92,	176,	176,	48,	198,	187
1490 DATA	114,	7,	68,	13,	116,	3,	178,	235,	728
1500 DATA	244,	87,	198,	5,	36,	186,	61,	1,	818
1510 DATA	188,	8,	232,	138,	186,	23,	42,	137,	285
1520 DATA	83,	8,	95,	198,	5,	8,	186,	186,	673
1530 DATA	6,	184,	8,	81,	285,	33,	114,	9,	632
1540 DATA	129,	216,	188,	62,	285,	33,	235,	18,	1888
1550 DATA	146,	185,	19,	8,	188,	8,	385,	329,	839
1560 DATA	115,	238,	188,	82,	1,	232,	45,	8,	899
1570 DATA	285,	32,	142,	6,	242,	1,	255,	54,	937
1580 DATA	245,	1,	38,	142,	6,	245,	1,	191,	878
1590 DATA	188,	6,	139,	247,	185,	128,	6,	242,	1884
1600 DATA	144,	174,	1,	148,	281,	59,	54,	242,	997
1610 DATA	1,	142,	8,	242,	1,	38,	142,	229,	831
1620 DATA	1,	116,	25,	285,	32,	188,	9,	285,	773
1630 DATA	33,	188,	195,	1,	188,	9,	285,	33,	842
1640 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1650 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1660 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1670 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1680 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1690 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1700 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1710 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1720 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1730 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1740 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1750 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1760 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1770 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1780 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1790 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1800 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1810 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1820 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1830 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1840 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1850 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1860 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1870 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1880 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1890 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1900 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1910 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1920 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1930 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1940 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1950 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1960 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1970 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1980 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195
1990 DATA	195,	195,	195,	195,	195,	195,	195,	195,	195

(PRNFILE.BAS ends)

ly and is not passed to BIOS. The standard rules for interrupts must be followed to emulate the BIOS. On entry, register AL contains the character to be printed and DX holds the printer number. On return, all registers except AH must be preserved. Register AH should contain the printer status. The diagram "Printer Return Status Byte" contains the bit assignments for this status byte. A 1 in any position indicates presence of the condition. Since there is no real printer involved, an artificial status code is returned. The value 90H signals printer "not busy" and "selected," meaning the print operation was successful.

We've already seen why a buffer is required. To add to the buffer, we first obtain the pointer to the next empty position in the buffer. Then a check is made to see if the buffer is already full. Unchecked, overflowing the buffer would result in writing in memory that doesn't belong to PRNFILE, the consequence of which is usually a locked machine. Therefore, if the buffer does overflow, the character that was to be printed must be discarded.

In the normal case, when the buffer is

not full, the character is stored and the pointer is advanced to the next position. The pointer is again tested to determine if there are at least 1,024 bytes in the buffer. If so, it's time to attempt to write to the disk. Setting WRITE_FLAG to 1 signals this need.

Before charging ahead with disk I/O, however, we must determine if DOS is already in the middle of another task. Unfortunately, DOS can handle only one function call at a time. Violating this rule is another sure way to crash the system. The undocumented DOS busy flag is used to determine if DOS is busy. If this flag is not zero, then DOS is active and the buffer can't be flushed yet. To prevent an overflow on the next character, the buffer must be made large enough to handle this common occurrence.

All three print functions must be implemented in order to emulate the BIOS interrupt 17h routine fully. When a printer reset is requested (function 1), WRITE_FLAG is set to 1, which causes the buffer to be flushed. A printer reset is performed each time PRNFILE is run. A printer status re-

quest (function 2) is serviced by always returning the value 90h, which indicates the printer is ready.

To ensure that a full buffer gets flushed at the earliest opportunity, interrupts 21h and 28h constantly monitor the buffer status. Every time that each of these interrupts completes, it checks the value of WRITE_FLAG. If it's equal to 1, then a call to WRITE_TO_FILE is made. This ensures that the buffer is flushed as soon as possible.

When interrupt 21h is intercepted, it's important to preserve the flags register by PUSHing and POPing. Most interrupt routines return with an IRET instruction, which restores the caller's flags from the stack (the INT instruction will have placed them there). But INT 21h signals error conditions by returning with the carry flag set. To manipulate the carry flag, therefore, NEWINT21 uses a RET 2 instruction. This does a FAR return and then discards the flags on the stack. The other bits in the flags word must be returned unchanged, however; to do this, they are PUSHed before any other instructions are

PRN2FILE BY MODEM

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If you use the Xmodem protocol, you can download PRN2FILE.COM directly, saving typing or downloading either the .BAS or the .ASM version. PRN2FILE.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create PRN2FILE.COM when run once in BASIC. PRN2FILE.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASH PRN2FILE;
LINK PRN2FILE;
EXE2BIN PRN2FILE PRN2FILE.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.



Tom Kihlken

PRN2FILE Command

1987/No. 22 (Utilities)

- Purpose:** Captures any output nominally directed to a printer as a file that can then be edited by a word processor or printed later.
- Format:** `PRN2FILE [d:][path]filename [/Pn] [/Bn] [/U]`
- Remarks:** PRN2FILE is a memory-resident program that is normally loaded as part of your AUTOEXEC.BAT file. It should be installed before other print utilities, such as a print spooler or the DOS MODE command. Once installed, the program may be run multiple times to change the *filename* (the drive and path default to the current directory unless otherwise specified) designated to receive the printer output.

Unless the *filename* is changed, successive print operations are appended to (rather than overwriting) the created file. To disable the printer output redirection, simply omit to specify a filename.

The optional */Pn* parameter designates the printer number (the default is LPT1) to be redirected. Note that output to a nonexistent printer (*/P2* in a one-printer system) is supported. This is another way to permit normal printing while PRN2FILE remains resident. Legal values for *Pn* range from 1 through 3.

The optional */Bn* parameter sets the buffer size. The default value is 4096 bytes, and values up to 64K may be specified. The buffer repeatedly empties when partially full in order to minimize the chance of buffer overflow, even when DOS may be called on for other activities than writing the buffer to disk. Should buffer overflow occur, an error message is produced but some data will be lost, so the file should be rewritten using a larger buffer.

The optional */U* parameter is used to unload PRN2FILE from memory. If other memory-resident utilities have been loaded after PRN2FILE and have chained onto the same interrupts, it will not be possible to unload the program and a message to this effect will be displayed.

All optional parameters may be entered in any order, but must each be separated by a single space (ASCII 32), which acts as a delimiter.

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Printer Return Status Byte

7	6	5	4	3	2	1	0
NOT BUSY	ACKNOWL- EDGE	OUT OF PAPER	SELECT	I/O ERROR	UNUSED	UNUSED	TIME OUT

executed. Now the flags can be used as needed as long as they are Popped before returning.

The mechanics of writing to a file are straightforward. The subroutine `WRITE_TO_FILE` contains the instructions to do it. It immediately sets `WRITE_FLAG` back to zero to prevent itself from being called again. Then the file is opened. If a "file not found" error is returned, a second call is needed to create the file. The file pointer can then be advanced to the end of file. This vital step is needed to avoid overwriting existing data in the file. The entire buffer contents are written using the DOS block write procedure (function 40h of interrupt 21h). If the buffer is completely full (an abnormal condition), the error message is also written to the file. The file is then closed and the buffer pointer reset to the first byte of the buffer.

Special provisions must be made for disk errors. Normally DOS signals these errors with its famous "Abort, Retry, Ignore" prompt. For a resident program, this just won't do. For one thing, the screen would get littered with the message. Another problem is that you just can't gracefully abort from within a resident program. The solution is to replace the severe error routine (INT 24h) with one that ignores all errors. After the file is safely written, the original INT 24h vector is restored.

BUFFER TIME-OUTS After using `PRN2FILE` you'll quickly become familiar with the buffered nature of the program. To demonstrate it, turn on redirection and print a few lines of something. Then immediately do a directory of the destination file. You'll probably notice it is still empty. The reason is that the printed data is still in the buffer. One way to remedy this is to run `PRN2FILE` again. This always flushes the buffer. I've added a second method, however, which is more

convenient. Approximately 5 seconds after the last character is printed, the buffer is automatically flushed. Redirection then proceeds as normal. This feature works best with programs that make frequent DOS function calls (most do).

To make time-outs work requires setting a counter each time a character is printed. Since the timer ticks 18.2 times each second, an initial value of 91 is used

■ To keep programs resident, you must instruct the operating system to preserve the memory.

for a 5-second time-out. On each tick of the internal clock, the counter is decremented (this is the reason for chaining into interrupt 8). If the counter reaches zero, `WRITE_FLAG` is set to 1 to indicate that the buffer should be written at the next opportunity. If another character is printed before the flush time is reached, the counter is again set to 91. When printing is continuous, the flush time is never reached. Only after printing stops does a time-out occur.

GETTING IT LOADED In the beginning all programs are created equal. What makes resident programs special is how they terminate. Normally, when programs finish, they are overlaid in memory by the next program. To keep them resident, you must instruct the operating system to preserve the memory. DOS provides special exit routines for this. They are accessed with either function 31h of interrupt 21h or interrupt 27h, and they allow you to speci-

fy the amount of code that must stay resident.

Resident programs are generally written in two parts: a portion that must stay resident and a transient portion. The resident part is located at the beginning of the file and the transient part last. When this format is used, the transient part can be released when the program terminates. In the case of `PRN2FILE`, however, the transient portion also remains resident. This is to simplify the process of allocating memory for the buffer. Since we've described how most of the resident part works, let's look at the transient part.

The first step is to display the copyright notice. Next, a search is made of the computer's memory for a previously installed copy of `PRN2FILE`. It's necessary (and desirable) to install the program only once per session. The ability to determine whether the program was already installed is therefore a key step. When the program is run again to change a parameter (such as the designation filename or printer number), the segment of the resident copy is determined and saved.

If a resident copy of `PRN2FILE` is detected, an additional step is required. Since the resident buffer may still contain some data left over from its last use, it must be emptied. If we failed to do this before changing the target filename, we could end up with a confusing mess, as data destined for the old file could end up in the new file. The easiest way to flush the buffer is to use the "initialize printer" function call. The resident copy of `PRN2FILE` intercepts the function call and interprets it as a command to empty the buffer.

The command line is now parsed for any specified parameters. DOS conveniently places any command line parameters at offset 81h in the Program Segment Prefix (PSP) and indicates the length of the string at offset 80h. The scan string instruction (SCASB) is perfect for locating any slashes (ASCII 2Fh). If any are found, the next character should be either B, P, or U. If other letters are found, an error message is printed and the program terminates.

The /P and /B parameters are quite simple, so let's look instead at how Uninstall works. Remember, the two things that make a resident program resident are having memory allocated to it and showing its

■ UTILITIES

presence in the interrupt vector table. To uninstall, we must undo these two steps. Getting out of the interrupt table is either simple or impossible. It's simple if the vectors we set are still there. In that case, we just put back the original vectors that were recorded during the install. But if another resident program has chained itself into one of the *same* vectors, we have no way of knowing what the new vector should be. If this happens, the "Cannot Uninstall" message is displayed. With the vector table restored, we relinquish the two memory segments that comprised the code and buffer. Then we take the normal exit to DOS, leaving not a trace of the once-resident program remaining.

To avoid confusing parameters (such as /P2) with the filename, each one is erased from the command string as it is processed. To erase letters, they are simply replaced with spaces. When command parsing is complete, only the filename

remains. This handy trick has the additional advantage that the parameters can be entered in any order without the need for complex logic to separate them.

■ The parameters can be entered in any order without needing complex logic to separate them.

Parsing the filename takes three steps. First, we determine if a drive letter was specified. Again the SCASB instruction is used, this time to locate the first letter of the filename. When the scan completes, register DI will point to a colon if a drive was entered. The drive letter is then copied

to the file specification string. Like the parameters, the drive is then erased from the command. If no drive was found, we use DOS function 19h to obtain the default drive.

The second step is to look for a path in the command string. This time we scan for a backslash. If one is found, the remaining path and filename are transferred to the file specification. Otherwise, the default path for the selected drive is obtained using function 47h.

Last, the remaining filename is copied. At the end of the completed string we add a null character (ASCII 0) to conform with the DOS convention that calls for an ASCII termination for filenames. The filename is also displayed on the screen at this time (using DOS function 9) to complete the redirection message.

Now we've got a filename. But is it a valid filename? If not—and we're not all perfect typists—then PRN2FILE can't do

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a thing. You could use a series of tests and compare instructions to confirm the syntax, but I decided instead to use a simple but foolproof method: just ask DOS to OPEN the file. If an error code is returned, then the name must be bad. When this happens, the error message "Invalid filename" is displayed and the program terminates. If the OPEN is successful, then the file is immediately closed and we can continue. (Actually, if the OPEN fails, a CREATE is also attempted since the OPEN will fail if the file doesn't exist.)

The next steps are required to transfer the new command parameters to the resident copy of the program. Two things must be copied: the printer number and the filename. The segment address of the already-resident copy has been determined by the search. The values are easily moved

can then be used by PRN2FILE as a marker for the buffer's end.

A funny thing happens if a full 64K buffer is specified. After BUFF_SIZE is converted to bytes, it becomes zero! The reason is simple. The largest integer that can be represented by a 16-bit word is just one less than 64K (or 65535). When /B64 is entered, BUFF_SIZE is set to FFFFh (the largest possible value), so you'll actually get short-changed by 1 byte.

The location of the DOS busy flag must now be determined using function 34h. It's needed each time a disk write is called for to make sure DOS isn't otherwise engaged. The flag is set by DOS itself to indicate when DOS is in an uninterruptible state. Though this function remains undocumented to this day, it forms a key part of many resident utilities that must access the disk.

Stealing interrupts is the name of the game for resident programs. The initial value of each of the four required vectors (8h, 17h, 21h, and 28h) is recorded in the data area. These are then replaced with the routines NEWINT08, NEWINT17, NEWINT21, and NEWINT28. DOS provides the services that aid and abet such thefts.

To finish the installation, the memory block allocated for the environment copy is released. It's of no value to PRN2FILE, and releasing it allows DOS to reuse it. To tell DOS we're finished for now but not to erase the resident code from memory is then as easy as saying "INT 21h." Thereafter, all programs will be loaded higher in memory so as not to interfere with the resident ones.

Originally, it appeared that PRN2FILE could be a very short program. After all, "Redirect the printer output" is easy to say. As it turned out, programming around the limitations imposed by the fact that DOS (in current versions) is not a multi-tasking operating system required quite a bit of code. Over half the program's 1,386 bytes are required to address this issue alone. Still, whenever you find you want to save printer output to a file, you'll be glad you added PRN2FILE to your utilities collection. 26

Tom Kihlken contributes frequently to PC Magazine.

■ To tell DOS we're finished but not to erase us from memory is as easy as saying "INT 21h."

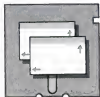
by setting the DS and ES registers to the current and preinstalled code segments. The printer number can be transferred by PUSHING it with the DS register and POPPING it with the ES register. To move the filename, the move string instruction (MOVSB) is used. Register CX contains the byte count, which is 128. This moves more data than necessary, but the code is more compact.

The last steps are performed only if this is the very first time the program has been run. Memory must be allocated for the buffer space. Since DOS always allocates all available memory for every program, we first release what we don't need. Then the buffer size (label BUFF_SIZE), which is in kilobytes, is converted into paragraphs by shifting it left six times (one K is 1,024 bytes, i.e., 64 paragraphs, i.e., 6 left shifts).

After allocating a segment for the buffer, we again rotate BUFF_SIZE by the factor of 10 to convert it to bytes. BUFF_SIZE

■ ENVIRONMENTS ■ CHARLES PETZOLD

EXPLORING THE OS/2 VIDEO INTERFACE



How DOS and OS/2 compare in video access procedure and speed; how the Kernel handles ANSI control codes; the OS/2 analogues of direct screen writing and pop-up windows.

Software for personal computers often involves a high degree of interaction with the user. The display reacts immediately to every keystroke; screen areas can be scrolled up or down, left or right; paragraphs are formatted dynamically; windows pop up with information.

That programs can use the video display so intensively is a result of the computer's hardware architecture. Video display memory is as addressable on the bus as is all other memory, so a program can display something on-screen by writing into this memory. This architecture has had profound consequences for the evolution of PC software. Spreadsheet programs we've become accustomed to using on PCs are almost inconceivable on a mainframe, because a mainframe is connected to terminals by cables. Despite the speed of processing within the mainframe, the bottleneck is the cable. A mainframe program cannot use the video display the way a PC program can.

Almost every applications program written for the IBM PC directly accesses video memory to achieve as fast a display response as possible. The facilities built into MS-DOS and the PC's BIOS for writing to the display have long ago been deemed inadequate. In one sense, PC software is as good as it is (and as fast as it is) precisely because programs take advantage of the computer's architecture and access video hardware directly.

THE DIFFERENCE FOR OS/2 Under a multitasking operating system (such as OS/2), direct access to the machine's hard-

ware by applications programs cannot be tolerated.

The hardware must be shared among multiple applications. If two programs attempt to write to the video display at the same time, the operating system must allow only one of the programs to succeed. The video output from applications must therefore go through the operating system before reaching the hardware.

Before I saw OS/2, I was nervous about the video display interface it would provide. I feared that the restrictions inherent in a multitasking operating system would cripple applications in the way they used the screen. If OS/2 had a slow character-mode video interface, I realized that prospects for the success of the operating system would be dim.

My fears were unfounded. The OS/2 Kernel contains a complete character-mode video interface with excellent performance. This interface replaces the PC

BIOS and goes beyond it in terms of speed and functionality.

Note: Beginning with this issue, I'll use mixed upper- and lowercase letters for the names of OS/2 Kernel functions. What was previously written as VIOWRTTY will now be shown as VioWrTTY. As I write this (early September), there's a move afoot at Microsoft to make this change. The sample programs in these columns will continue to use full uppercase function names, however, because that's the only way I can compile them without making extensive changes to header files provided with the OS/2 Software Development Kit. [Our style conventions will try to track such ongoing changes. We could only wish that Microsoft had not chosen to employ such Germanic-length function names in the first place.—Ed.]

TESTING OS/2 VIDEO I recently converted the PC Labs standard character-mode video benchmark tests to OS/2. The results, using an 8-MHz IBM PC AT connected to an IBM EGA in a 25 by 80 mode, are shown in "Performance Tests: DOS and OS/2."

The first test involves ten repetitions of clearing the screen, homing the cursor, and writing 24 60-character lines (including a terminating carriage return and line feed) in a teletype fashion. The DOS version of the benchmark test uses the BIOS interrupt 10h function call 6 to clear the screen, function call 2 to set the cursor, and function call 14 to write teletype output to the screen. The OS/2 version uses

■ Under a multitasking operating system (such as OS/2), direct access to the machine's hardware by applications programs cannot be tolerated.

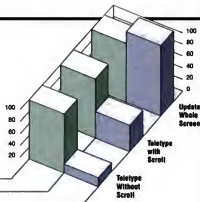
■ ENVIRONMENTS

Performance Tests:
DOS and OS/2

Results show OS/2 video output to be markedly faster than that of DOS. The slower time of a single OS/2 screen update is only a matter of milliseconds and not visible to the human eye.

Performance Times
(Times given in seconds)

	Teletype Without Scroll	Teletype with Scroll	Update Whole Screen
DOS	8.52	12.47	9.06
OS/2	1.31	5.59	11.13

Relative Times
(DOS = 100)

The Teletype Without Scroll test clears the screen and writes 24 lines of 80 characters each to the display. The result shown is the total of the ten trials. The DOS version of the test clears the screen with BIOS interrupt 10h function call 6, sets the cursor with call 2, and teletypes to screen with call 14. In OS/2 the same tasks are performed using the VioScrollUp, VioSetCurPos, and VioWrTTY functions.

The Teletype with Scroll test clears the screen, sets the cursor at home for the first 24 lines of the routine, and writes 240 lines of 80 characters each to the display. The DOS and OS/2 versions of the test use the same functions as the Teletype Without Scroll test to perform the tasks.

The Update Whole Screen test updates the entire screen 1,000 times with a single character and attribute by writing directly to video memory. The DOS version of the test updates the screen using the assembly language REP STOSW instruction. In the OS/2 version, the same task is performed using the VioWrtCell function.

the VioScrollUp, VioSetCurPos, and VioWrTTY functions (described later) to duplicate these tasks. The OS/2 version of this test runs over six times as fast as the BIOS version under DOS.

The second test is similar to the first except that the screen is cleared and the cursor homed only at the beginning of the test. Then, 240 60-character lines are written to the display. This requires that the display be scrolled by the BIOS or the OS/2 Kernel functions. The OS/2 version of the test runs more than twice as fast as the BIOS version.

The DOS version of the third test updates the entire screen 1,000 times with a single character and attribute by writing directly to video memory using the assembly language REP STOSW instruction. In the OS/2 version, I used the VioWrtNCell function (also described later).

The OS/2 version of this third test runs about 20 percent slower than the DOS version. Because the DOS version does this task as quickly as possible, obviously the OS/2 version could not run any faster. This test shows the penalty involved in using the OS/2 function calls instead of writing directly to the screen. OS/2 requires 11 milliseconds to update the whole screen

with a single character and attribute, rather than 9 milliseconds. In real life, the difference is not noticeable.

THE NEW STANDARD No PC programmer really likes to write directly to video memory. We've been forced into it by the inadequate performance of DOS and the PC BIOS. OS/2 gives us an alternative that is nearly as fast as direct access and uses OS/2 function calls. To me, this is one of the most liberating aspects of OS/2.

Obviously the OS/2 character-mode video I/O function calls are an important part of the operating system because they will be used by every OS/2 Kernel character-

mode application that uses the display in a full-screen mode. In short, this is the new character-mode video I/O standard.

All OS/2 Kernel functions for video I/O begin with the letters Vio. An OS/2 Kernel program that uses this set of functions is called a VIO application. (VIO may be pronounced "vee-i-oh" or "vy-oh" as you prefer.)

THE TELETYPE APPROACH The easiest way to write to the display is to treat it as a simple teletype device. Output begins at the current cursor position. The cursor is incremented as the text is written. A few simple control characters are understood: carriage returns (ASCII code 13), line feeds (10), beeps (7), backspaces (8), and tabs (9). Text that extends beyond the end of a line is wrapped to the next line. If text reaches the bottom of the display, the screen is scrolled.

Under the OS/2 Kernel, the highest-level function that sends teletype output to the screen is DosWrite, which is not a VIO function. In C, you call DosWrite to write to the screen like this:

```
DosWrite (1, &buffer, bufferSize, &written);
```

DosWrite is very similar to the DOS inter-

■ OS/2 gives us an alternative that is nearly as fast as direct access and uses OS/2 function calls.

rupt 21h function call 40h. The first parameter is the file handle. Using 1 means standard output, just as in DOS. This is followed by parameters for a pointer to a buffer containing the text and the length of the text. The last parameter is a pointer to a variable that receives the number of bytes actually written.

You should use DosWrite in any program where redirection of standard output might be desired by the user. I used DosWrite in the ENVIRON program in Environments, Volume 6 Number 20. Many normal C video output functions (such as printf) translate into DosWrite calls.

If possible redirection of output is not a concern, you can use the VioWrtTTY function:

```
VioWrtTTY (aBuffer, bufferSize, 0);
```

The last parameter (documented as a "video handle") is always zero under the OS/2 Kernel.

These two functions are virtually identical except that DosWrite output can be redirected but VioWrtTTY output always goes to the screen. If standard output is directed to the screen, DosWrite simply calls VioWrtTTY.

When I first started programming for OS/2, I naturally assumed that VioWrtTTY would be much faster than DosWrite. After all, when a program uses the DOS function call 40h to write to the screen, DOS passes the output to the CON device driver, character by character. The device driver then calls the BIOS teletype function for each character. DOS cannot pass the entire buffer to the device driver because DOS, not CON, expands tabs.

My initial attitude toward DosWrite (which I suspect will be shared by many people who come to OS/2) demonstrates how much our minds have been polluted by the trashy operation of DOS. Under OS/2, there is virtually no speed penalty in using DosWrite. Most of the OS/2 internal and external functions (such as DIR and TYPE) use DosWrite with good results: the OS/2 TYPE command is more than twice as fast as the DOS TYPE command.

PARTIAL ANSI The character strings passed to DosWrite and VioWrtTTY can contain ANSI control sequences. ANSI in-

■ Under OS/2, there is virtually no speed penalty in using DosWrite. Most of the OS/2 internal and external functions use it with good results.

terpretation is built into OS/2 as a default. If you want to use ANSI control sequences in an OS/2 program, you're free to do so without requiring users to put a DEVICE=ANSI.SYS statement into their CONFIG.SYS files.

ANSI control sequences let you position the cursor; move the cursor up, down, left, and right; erase the display; erase a

line starting at the cursor position; set attributes (such as color); and redefine the keyboard. The OS/2 ANSI control sequences do not go beyond those defined in DOS, however, and this is a very small subset of the ANSI X3.64-1979 specification. Apparently Microsoft didn't feel a need to beef up the ANSI support in OS/2 because nobody uses ANSI very much. (And why not? Because it's incomplete, of course.)

An external command named ANSI.EXE turns ANSI interpretation on and off for a screen group. A program can also turn ANSI support on and off through the VioSetAns function.

MORE VIO FUNCTIONS The DosWrite and VioWrtTTY functions begin writing screen output at the current cursor position. You can change the cursor position by calling

```
VioSetCurPos (row, col, 0);
```

The following function obtains the current cursor position:

```
VioGetCurPos (&row, &col, 0);
```

The current position of the cursor must be obtained by passing two pointers to the function—two addresses of variables that will be set to the current row and column when the function returns.

Next is a set of functions that can write to any place on the screen, but do not alter the position of the cursor in the process. These functions do not interpret control characters (such as carriage returns or line feeds) or ANSI control sequences. Text that exceeds the limit of a line will wrap to the next line, and text that goes past the end of the screen will not cause the display to scroll. In other words, these functions treat the video display as simply a linear block of memory.

These functions are shown in the table "VIO Functions in OS/2." Each of them takes a row and column starting position and a pointer to the character string, attribute string, or combined character and attribute string.

You can also read the screen starting at a specified row and column position for a specified length using either the VioReadCellStr (read string of alternating characters and attributes) or VioReadCharStr (read string of characters only).

VIO Functions in OS/2

OS/2 function	Writes to the screen:
VioWrtCellStr	String of alternating characters and attributes
VioWrtCharStr	String of characters (does not change existing attributes)
VioWrtCharStrAttr	String of characters with single specified attribute
VioWrtNCell	Single character and attribute written n times
VioWrtNChar	Single character written n times
VioWrtNAttr	Single attribute written n times

OS/2's VIO functions write characters and attributes to the screen starting at a specified row and column position

■ ENVIRONMENTS

AScroll Around the Screen It has always frustrated me that while the PC BIOS had routines to scroll a window on the screen up or down, it couldn't scroll sideways. OS/2 corrects this deficiency.

There are four scrolling functions—VioScrollUp, VioScrollDn, VioScrollLf, and VioScrollRt. Each of the functions takes a starting and ending row, a starting and ending column, the number of lines to scroll, and the cell (character and attribute) used to fill the area uncovered by the scroll.

If the starting row and column are set to zero, the ending row and column set to -1, and the number of lines is set to -1, then the entire screen will be filled with the cell. This is the recommended way to clear the screen.

THE LOGICAL BUFFER APPROACH

Some programmers might feel more comfortable getting access to a block of video memory and manipulating it directly. This facility is also provided by the OS/2 Kernel. You first call VioGetBuf to obtain the address and length of a block of memory called the logical video buffer:

```
VioGetBuf (&logicalbuffer, &length, 0);
```

The length of this buffer is the same as the length in bytes of the physical display memory associated with the current video mode. You treat this logical buffer as if it were real video memory by simply writing characters to it. When you want to update the real screen with this buffer, you call

```
vioshowbuf (offset, length, 0);
```

Starting at the specified offset in the logical buffer and for a specified length, the logical buffer is then copied to the real video buffer.

For many existing programs that currently write directly to the screen, this is perhaps the easiest approach to converting the program to the OS/2 Kernel. Rather than use B000:0000 or B800:0000, you just obtain an address from VioGetBuf and write to that. At strategic points in the program, you update the screen from the buffer using VioShowBuf.

WORKING WITH VIDEO MODES

Programs running under the OS/2 Kernel can obtain information that indicates the

video adapter type (currently monochrome, CGA, and EGA), the monitor type (currently monochrome, color, or enhanced color), and video memory size by calling VioGetConfig. This function allows a program to identify the video hardware. (Obviously, the function in the retail version of OS/2 will also include codes for the PS/2 VGA adapter and monitors.)

A program can obtain the current video mode for the screen group by a call to VioGetMode. This allows the program to determine the number of character rows and columns and other information. The video mode is identified not by the codes used in the PC BIOS, but rather by a structure called ModeData defined in the header file SUBCALLS.H, a file included with the OS/2 Software Development Kit. This structure contains the fields shown in the

ModeData's Video Information Fields

Field	Size (bytes)	Description
length	2	Length of structure
type	1	Text or graphics flag
color	1	Number of color bits
col	2	Number of character columns
row	2	Number of character rows
hres	2	Horizontal resolution
vres	2	Vertical resolution

table "ModeData's Video Information Fields."

A C program can define a structure (named md, for example) of type ModeData like this:

```
struct ModeData md;
```

Before calling VioGetMode, the first field of the structure must be set to the length of the structure:

```
md.length = sizeof md;  
VioGetMode (&md, 0);
```

An OS/2 Kernel program can use this same structure with the VioSetMode function to set a different video mode. Of course, the video mode must be supported by the adapter.

The EGA43.C program shown in Fig-

ure 1 shows how VioGetConfig, VioGetMode, and VioSetMode can be used to switch an EGA to 43-line mode under the OS/2 Kernel. If you have the OS/2 Software Development Kit properly installed, you can compile and link this program by the command

```
CL -G2 -Zp EGA43.C
```

The program first uses VioGetConfig to determine if the machine has an EGA board with an enhanced color monitor. Using the VioSetCurType function, EGA43 also changes the cursor to a block. According to OS/2 documentation, VioSetMode does not clear the screen or change the cursor position. While the former is true, VioSetMode currently homes the cursor, so the cursor position is saved before the mode change and restored afterwards.

The OS/2 Kernel also includes a function named VioSetState that can set the EGA palette, set the border color, and switch between using the high bit of the attribute code for background intensity or for blinking. Other OS/2 Kernel functions obtain pointers to fonts stored in the PC ROM BIOS or can be used to set an EGA font from a font table supplied by the program.

POPPING UP As I've discussed in previous columns, OS/2 divides a session into screen groups. Only screen output from the program running in the current screen group (the visible screen group) goes to the physical screen. However, programs running in the other screen groups (except the DOS Compatibility Box screen group) continue to run. Because the programs use the OS/2 VIO functions to write to the screen, OS/2 can save video output from the other screen groups in separate blocks of memory. When the user switches among screen groups, OS/2 saves the contents of the video display associated with the current screen group and restores the screen image from another screen group.

There are times when a program running in the noncurrent screen group must notify the user of something. The program can do this by making a call to VioPopUp.

VioPopUp causes OS/2 to save the display memory of the current screen group, change the video mode to a normal 25 by 80 text mode, and clear the screen. This is a special "pop-up screen." The program

```

/* EGA43.C--OS/2 program to switch to EGA 43-line mode */
/* Programmed by Charles Petsold, 1987 */

#include <subcalls.h>

main ()
{
    struct ConfigData cd ;
    struct ModeData md ;
    struct CursorData cnd ;
    unsigned int row, col ;
    static char errmsg [] = "Requires EGA board and display" ;

    cd.length = sizeof cd ;
    VIOGETCONFIG (&cd, 0) ; /* get video hardware code */

    if (cd.eadapter_type == 2 && cd.display_type == 2)
    {
        md.length = sizeof md ;
        VIOGETMODE (&md, 0) ; /* get current video mode */

        VIOGETCURPOS (&row, &col, 0) ; /* get cursor position */

        VIOGETCURTYPE (&cnd, 0) ; /* get cursor type */

        md.row = 43 ;
        VIOSETMODE (&md, 0) ; /* switch to 43 line mode */

        cnd.cur_start = 0 ;
        cnd.cur_end = 7 ;
        VIOSETCURTYPE (&cnd, 0) ; /* set the cursor to a block */

        VIOSETCURPOS (row, col, 0) ; /* restore the cursor position */
    }
    else
        VIOWRITE (errmsg, sizeof errmsg - 1, 0) ;

    return 0 ;
}

```

Figure 1: EGA43.C shows switches to 43-line mode using OS/2 VIO calls.

calling VioPopUp can then write to this screen, read the keyboard, and so forth. When the program is finished using the pop-up screen, it then executes the VioEndPopUp function. This returns to the screen group that was interrupted.

VioPopUp is used mostly by background programs executed via the OS/2 DETACH command. Normally, programs that are DETACHED run in a special screen group to prevent their video output from interfering with the foreground process of the screen group. The only way these programs can display something to the screen is to issue a VioPopUp.

THE WAKEUP PROGRAM Figure 2 shows a program called WAKEUP that uses VioPopUp in this way. If you want to be awakened at 5:30 P.M., you can run

DETACH WAKEUP 17:30

The DETACH command causes WAKEUP to be executed in the back-

ground, and the OS/2 command line prompt returns when you run it. WAKEUP first determines the difference between the time specified in the WAKEUP command line and the current time. It then calls DosSleep, which suspends operation of a program for a specified period of time. When DosSleep returns, WAKEUP calls VioPopUp to put a message on the screen. It frantically beeps the PC speaker by calling DosBeep and alternates the color of the screen between white text on a red background and red text on a white background. (If that doesn't wake you up, perhaps you need the sleep.) When you press a key, WAKEUP calls VioEndPopUp and terminates normally.

You can use DETACH to run WAKEUP as often as you like during an OS/2 session with many different wakeup times. Each copy runs independently in the background. If you simply run WAKEUP from the command line without DETACH, it runs as a normal program and you cannot

do anything more in the screen group until it terminates normally (after the pop-up) or you press Ctrl-Break.

DOS-TYPE POP-UPS UNDER OS/2?

The operation of VioPopUp is not quite what you would expect if you're familiar with DOS RAM-resident pop-up programs such as *SideKick*. When these programs pop up, they appear in a window on top of existing programs. VioPopUp, on the other hand, completely clears the screen and gives the program access to the entire blank screen.

There are reasons why *SideKick*-type pop-ups are not suited for the OS/2 Kernel. Suppose, for example, that you're running a communications program and you're downloading a text file on-screen and saving it into a file. You pop up a RAM-resident program in the middle of this. Under DOS, the communications program will be suspended while the pop-up is on the screen. (This might lead to problems, of course. The input buffer could overflow, and the program might miss some input. That's just one of the many reasons why RAM-resident programs such as *SideKick* are not viable under DOS and continue to give users problems.)

Under OS/2, however, the underlying communications program would continue to run. There is no way—and there should be no way—for the pop-up program to suspend the communications program. If the pop-up program were able to write to the same screen the communications program

■ VioPopUp is used mostly by background programs executed via OS/2 DETACH.

was using, the communications program might then write over the part of the screen occupied by the pop-up.

To prevent this, then, the OS/2 Kernel assigns a DETACHED program its own special screen group. The only way a DETACHED program can display visible out-

■ ENVIRONMENTS

```

/* WAKEUP.C--Popup Alarm for OS/2 Kernel          */
/*          Programmed by Charles Petzold, 1987 */

#include <doscalls.h>
#include <subcalls.h>
#include <conio.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

main (argc, argv)
int  argc ;
char *argv [] ;
{
    static char    msg [] = "WAKE UP! WAKE UP! WAKE UP!";
    static char    delim [] = "," ;
    struct DateTime datetime ;
    unsigned int    hour, min, i, waitflags = 1 ;
    long            wakeuptime, currenttime ;

    if (argc < 2 || 23 < (hour = atoi (strtok (argv [1], delim))) ||
        59 < (min = atoi (strtok (NULL, delim))))
    {
        puts ("\nsyntax: WAKEUP hour:minute    (24-hour format)");
        return 1 ;
    }

    wakeuptime = (hour * 60 + min) * 60000L ;

    DOSGETDATETIME (&datetime) ;

    currenttime = ((datetime.hour * 60 + datetime.minutes) * 60L +
        datetime.seconds) * 1000L ;

    if (wakeuptime < currenttime)
        wakeuptime += 24 * 3600000L ;

    DOSSLEEP (wakeuptime - currenttime) ;

    VIOPOPUP (&waitflags, 0) ;

    VIOSETCURPOS (12, (80 - sizeof (msg)) / 2, 0) ;
    VIOWRITE (msg, sizeof (msg) - 1, 0) ;

    while (1 < kbhit ())
    {
        VIOWRITEATTR ("\x4F", 25 * 80, 0, 0, 0) ;

        for (i = 1 ; i < 10 ; i++)
        {
            DOSBEEP (500, 50) ;
            DOSBEEP (1000, 50) ;
        }

        VIOWRITEATTR ("\x74", 25 * 80, 0, 0, 0) ;

        for (i = 1 ; i < 10 ; i++)
        {
            DOSBEEP (1000, 50) ;
            DOSBEEP (2000, 50) ;
        }

    }

    VIOENDPOPUP (0) ;
    return 0 ;
}

```

Figure 2: Written in C for OS/2, this is one alarm clock you won't sleep through.

put is by calling the VioPopUp function.

Why this restriction? Well, anything else would have required the OS/2 Kernel to include the concept of a screen "clipping region" to prevent one program from writing over a window used by another. But this would then require that the Kernel support everything else connected with windowed programs, such as directing keyboard input to one of several multiple programs running on one screen.

The OS/2 Kernel doesn't have all this because windowing is really the job of the

■ When we begin talking about graphics, we really need to start exploring the Presentation Manager.

OS/2 Presentation Manager. Under the Presentation Manager, every program becomes a pop-up.

But there is a possible compromise. One of the developers of OS/2 told me that they were considering modifying VioPopUp so one of the input flags would specify that the pop-up screen not be cleared. The contents of the interrupted screen would thus appear on the pop-up screen, but the screen would no longer be used by the program that the pop-up program interrupted. This would provide the illusion of a DOS-type pop-up and allow the pop-up program to capture parts of the screen, perhaps like the *SideKick* Notepad. That's a good idea, and I hope they do it.

MOVING ON TO GRAPHICS The OS/2 Kernel VIO functions are basically for character-mode video output. When we begin talking about graphics, we really need to start exploring the Presentation Manager. In the next column we'll look at other ways that OS/2 programs can use the screen, including graphics in the Presentation Manager, graphics without the Presentation Manager, and (perhaps most surprising of all) how a program can use character-mode VIO functions in the Presentation Manager.

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PARSING ROUTINES IN C AND ASSEMBLER



Handling command line arguments can be a messy chore, especially in assembly language. Here are equivalent C and MASM routines you can put in your library to facilitate the task.

I've probably written little MASM sub-routines that look for a command line filename, or that take some action based on a command line switch, at least 50 times in the last few years. Yet despite the noble sentiments in my last column about modularization and reusability of code, I've never bothered to write some general-purpose MASM routines that would take care of this problem. To make up for this lapse, I'll introduce you to the facilities for command line argument processing provided by the C language, and will then go on to develop similar MASM procedures.

But first, some terminology. The *command line* is the line entered by the user to run a program. It contains the name of the program, optionally followed by other parameters separated by spaces, tabs, or other delimiters, and is terminated with a carriage return. The *command tail* is what remains of the command line after the program name and any redirection or piping parameters have been removed. MS-DOS places the command tail of a program at offset 80H in its program segment prefix (PSP), in the following form: a byte containing the length of the command tail, followed by the text of the command tail itself, followed by a carriage return (0Dh) that is not included in the count. Each filename, switch, or other parameter in the command tail is called a *command tail argument*.

C provides programmers a mechanism that makes it very easy to inspect command tail arguments within a program. The program's startup code (which is auto-

matically inserted into every C program by the Linker) inspects the command tail, counts the arguments, and converts each argument into a null-terminated (ASCIIZ) string. It then passes the argument count and an array containing the addresses of the ASCIIZ strings to the main routine of the program, as the integer *argc* and the pointer array *argv[]*, respectively.

As a further convenience, when the host operating system makes the information available (DOS 3.x does), the startup code provides the name of the program itself in the form of an ASCIIZ string, as command line argument *argv[0]*. The program can use *argv[0]* to find its data files, overlays, and the like in cases where the current directory is not the one from which the program was loaded. If the program name is not known, *argv[0]* will point to a dummy string of some kind. Thus, the value of *argc* is 1 or greater, even if the command line used to load the program contains no arguments at all.

SHOWARGS.C (Figure 1) illustrates how *argc* and *argv* are used in a C pro-

gram. It begins by displaying the number of command tail arguments and then continues on to display the arguments themselves on separate lines. For example, if you compile SHOWARGS.C into SHOWARGS.EXE and then enter

SHOWARGS CAT DOG DUCK

you will see

The command line contains 4 arguments
Argument 0 is: C:\PC\MAG\SHOWARGS.EXE
Argument 1 is: CAT
Argument 2 is: DOG
Argument 3 is: DUCK

More is going on here than meets the casual eye. The C startup library looks for "white space" between the command tail arguments, and it treats any combination of tabs and spaces as a single separator. It makes an exception, however, for text enclosed within a pair of double quotes. Such text gets passed as a single argument. For instance, the command

SHOWARGS "CAT DOG" DUCK

will display

```
#include <stdio.h>

main(argc,argv)
int argc;
char *argv[];
{
    int x;
    printf("\nThe command line contains %d arguments", argc);
    for (x=0; x<argc; x++)
        printf("\nArgument %d is: %s ", x, argv[x]);
    puts("");
}
```

Figure 1: SHOWARGS.C provides a demonstration of command line argument processing in C.

■ POWER PROGRAMMING

```
The command line contains 3 arguments
Argument 0 is: C:\PC\MAG\SHOWARGS.EXE
Argument 1 is: CAT DOG
Argument 2 is: DUCK
```

The library also checks the currently running version of MS-DOS, since the program name (`argv[0]`) can only be determined in MS-DOS, Version 3.0 or later. For earlier MS-DOS versions, Microsoft C returns the string 'C' for `argv[0]`, while Turbo C returns a null string.

When a filename that includes wildcard characters (* or ?) is passed to a program, all the filenames that match the argument must then be processed. Microsoft C 5.0 includes an object module, SETARG-V.OBJ, that you can link with your program to carry out filename expansion and matching automatically.

For example, let's produce a new **SHOWARGS.EXE** file by recompiling and linking our little **SHOWARGS** program to include **SETARGV.OBJ**.

CL SHOWARGS.C SETARGV

If the current directory contains the files TEMP1.DAT, TEMP2.DAT, and TEMP3.DAT, the command

SHOWARGS TEMP*,*

will display

```
The command line contains 4 arguments
Argument # is: C:\PCMGK\SNOMARGS.EXE
Argument 1 is: TEMP1.DAT
Argument 2 is: TEMP2.DAT
Argument 3 is: TEMP3.DAT
```

If no files match the argument containing wildcard characters, it is passed to the program unchanged.

If your C program does not use `argc` and `argv[]`, you can reduce its size by providing a dummy function to replace the C runtime library's command tail parsing function. The name of this function may vary from compiler to compiler. In Microsoft C, you would include a function declaration of the following form in your main program module:

```

setargv( )
{
}

```

MASM COMMAND LINE ARGU-

MENTS Examining the command line arguments in a MASM program is a messy process at best. An .EXE program is passed the segment address of the PSP in registers DS and ES at entry, but it usually resets these registers in a hurry in order to get at the variables and constants in its own data segment. Thus, the program must either put the PSP address away somewhere if it expects to look at the command tail later, or it must copy the command tail to another buffer within its data segment. (In MS-DOS Version 3, interrupt 21H function 62H can be called at any time to get the PSP address, but it's really not worth the trouble to include special code just to use this function when it's available.)

To make matters worse, the program name (corresponding to a C program's `argv[0]`) is stored at the end of the program's environment block in a different segment altogether from either the PSP or the program's data. A program that wants to look at its own name must first make an MS-DOS call (interrupt 21H function 30H) to make sure the name is available, pick up the segment of the environment block from offset 002CH of the PSP, and then scan past all the variables (`PATH=`, `PROMPT=`, etc.) in the environment block.

In order to put this problem to rest (for the purposes of future columns, anyway), I have written two general-purpose MASM procedures that provide command tail argument counting and pointers. These subroutines, called (by a strange coincidence) `argc` and `argv`, work just as you would expect from our previous discussion of the C language `argc` and `argv` [1].

The procedure `arg` (Figure 2) is passed the address of the command tail in registers ES:BX and returns the number of command tail arguments in register AX. Multiple tabs and/or blanks are treated as a single separator between arguments. For symmetry with C, the value returned is always at least 1 (i.e., `arg` counts the program name as an argument, even though that name is not actually present in the PSP command tail data).

The procedure a r g y., listed in Figure 3,

```

Name      argc      --- return argument count
Title

;
; argc.AM: return count of command line arguments.
; Truncate blanks and tabs as whitespace, carriage
; return as terminator.
;
; (C) 1987 Riff Communications Co.
;
; Call with: $R0=$ command line
;
; Returns:  AX = argument count (always >=1)
;           Other registers preserved
;

CR      equ      0dh      ; ASCII carriage return
lf      equ      0ah      ; ASCII line feed
tab     equ      09h      ; ASCII tab
blank   equ      20h      ; ASCII space character

_TEXT   segment word public 'CODE'

assume  cs:_TEXT

public  argc

argc    proc      near      ; make argc available to linker

; count command line arguments

push    bx      ; save original BX and CX

push    cx      ; for later
mov     ax,1     ; force count >= 1

argc1:  mov     cx,-1     ; set flag = outside argument

argc2:  inc     bx      ; point to next character
        cmp     byte ptr es:[bx],cr
        jz      argc3    ; wait if carriage return
        cmp     byte ptr es:[bx],blank
        jz      argc1    ; outside argument if ASCII blank
        cmp     byte ptr es:[bx],tab
        jz      argc1    ; outside argument if ASCII tab
        jcxz    argc2    ; otherwise not blank or tab,
                        ; jump if already inside argument

        inc     cx      ; else found argument, count it
        not     ax      ; set flag = inside argument
        jmp     argc2    ; and look at next character

argc3:  pop     cx      ; restore original BX and CX
        pop     ret      ; return AX = argument count

argc    endp

_TEXT   ends

end

```

Figure 2: *ARGC.ASM*, a MASM equivalent of C's *arg.c*.

is passed the address of the command tail in registers ES:BX and an argument number in AX, and returns a pointer to that argument in ES:BX with the length of the argument in AX. If the argument is not present (i.e., if argv is called with AX greater or equal to the value returned by argc), AX is returned as zero. The routine contains special code for argv[0] and returns a pointer to the program name from the environment block if possible.

Presenting these handy procedures gives me an excuse to introduce you to the idea of modular MASM programming. You can assemble argv and argc independently and keep them around on your disk as object module (.OBJ) files, or you can put them into a library, so they can be

linked into a program whenever you need them. To illustrate this process, I've written a short demonstration program called SHOWARGS.ASM (see Figure 4). Note that ARGV.ASM and ARG.C.ASM each contain PUBLIC declarations of their main procedure names, so that those names will be visible to the Linker, and SHOWARGS.ASM contains two EXTRN statements to tell the assembler that the ARG.C and ARGV routines will be linked in later.

First, assemble the three files that are of interest:

```
MASM SHOWARGS;
MASM ARGV;
MASM ARG.C;
```

Then link the three modules into the executable file SHOWARGS.EXE:

LINK SHOWARGS+ARGV+ARG.C;

Having done this, if you next enter the command

```
SHOWARGS CAT DOG DUCK
```

you will see

```
The command line contains 04 arguments
Argument 00 is: C:\PC\MAG\SHOWARGS.EXE
Argument 01 is: CAT
Argument 02 is: DOG
Argument 03 is: DUCK
```

For even more convenience, you can insert ARGV.OBJ and ARG.C.OBJ into an object module library and let the Linker extract the routines from the library when it needs them. First, to create the library

<pre> name argv title argv --- return argument pointer ; ARGV.ASM: return address and length of specified ; command line argument or fully qualified program ; name. Treats blanks and tabs as whitespace, carriage ; return as terminator. ; (C) 1987 Ziff Communications Co. ; Call with: ES:BX = command line address ; (implicit ES:BP segment) ; AX = argument number (0 based) ; Returns: ES:BX = argument address ; AX = argument length ; (0=argument not found) ; Other registers preserved. ; If called with AX=0 (argv[0]) and running under ; MS-DOS version 3.0 or later, returns ES:BX pointing ; to program name in environment block and AX=length, ; otherwise returns ES:BX unchanged and AX=0. cr equ 8dh ; ASCII carriage return lf equ 9ah ; ASCII line feed tab equ 9dh ; ASCII tab blank equ 20h ; ASCII space character _TEXT segment word public 'CODE' assume cs:_TEXT public argv argv proc near ; get address & length of ; command tail argument push cx ; save original CX and DI push di or ax,cx ; is it argument 0? je argv0 ; yes, jump to get program name xor ah,ah ; initialize argument counter argv1: mov cx,-1 ; set flag = outside argument argv2: inc bx ; point to next character cmp byte ptr es:[bx],cr je argv3 ; exit if carriage return cmp byte ptr es:[bx],blank je argv1 ; outside argument if ASCII blank cmp byte ptr es:[bx],tab je argv1 ; outside argument if ASCII tab ; if not blank or tab...</pre>	<pre> jcxz argv2 ; jump if already inside argument inc cx ; else count arguments found cmp ah,al ; is this the one we're looking for? je argv4 ; yes, go find its length not cx ; no, set flag = inside argument jmp argv2 ; and look at next character argv4: ; found desired argument, now ; determine its length... mov ax,bx ; save param. starting address argv5: inc bx ; point to next character cmp byte ptr es:[bx],cr je argv6 ; found end if carriage return cmp byte ptr es:[bx],blank je argv6 ; found end if ASCII blank cmp byte ptr es:[bx],tab je argv5 ; found end if ASCII tab argv6: sub bx,ax ; set ES:BX = argument address sub ax,bx ; and AX = argument length jmp caller ; return to caller argv7: xor ax,ax ; set AX = 0, argument not found jmp caller ; return to caller argv8: ; special handler for argv=0 ; check if DOS 3.0 or later ; (force AX=0 in case DOS 1) mov ax,3000h int 21h cmp al,3 je argv7 ; DOS 1 or 2, return null param. xor ax,ax ; force AX=0 in case DOS 1 ; find the program name by ; first skipping over all the ; environment variables... argv9: repne scasb ; scan for double cull (can't use ; (SCAS since might be odd addr.) ; loop if it was a single cull ; skip count word in environment ; save program name address ; now find its length... mov bx,di mov cx,-1 repne scasb not cx dec cx mov ax,cx ; return length in AX argv10: pop di ; common exit point pop cx ; restore original CX and DI ret argv endp _TEXT ends end</pre>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 3: ARGV.ASM, a MASM equivalent of argv[] in C.

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■ POWER PROGRAMMING

<pre> name showargs title SHOWARGS --- argc std argv demo ; ; SHOWARGS.ASM --- demonstrate command line parsing ; with argc.ASM and ARGV.ASM ; ; (C) 1987 Ziff Communications Co. ; stdin equ 0 ; MS-DOS handle for stdout equ 1 ; standard devices stderr equ 2 cmdtail equ 00h ; offset of command tail ; in program segment prefix cr equ 0dh ; ASCII carriage return lf equ 0ah ; ASCII line feed blank equ 020h ; ASCII blank tab equ 09h ; ASCII tab extern argc:near ; returns argument count extern argv:near ; returns pointer to argument DGROUP group _DATA,STACK _TEXT segment word public 'CODE' assume cs:_TEXT,ds:DGROUP,ss:STACK main proc far ; entry point from MS-DOS mov ax,DGROUP ; make our data segment mov ds,ax ; addressable mov psp,ss ; save segment of PSP mov bx,cmdtail ; ES:BX = command tail call argc ; get number of command ; line arguments mov para,ax ; and save it mov bx,offset msg1 ; convert count to ASCII call b2dec ; for output mov dx,offset msg1 ; display the number of mov cx,msg1_len ; command line arguments mov bx,stdout ; mov ah,40h ; int 21h main1: mov ax,count ; display next argument cmp ax,para ; are we all done? je main2 ; yes, exit mov bx,offset msg2 ; no, convert argument number call b2dec ; mov dx,offset msg2 ; and display the number mov cx,msg2_len ; mov bx,stdout ; mov ah,40h ; int 21h mov ax,count ; now get the actual argument mov ee,psp ; ES:BX = command tail </pre>	<pre> mov bx,cmdtail call argc push ds ; save our data segment and push es ; display argument string pop ds mov dx,bx ; now DS:DX = argument addr mov cx,ax ; and CX = argument length mov bx,stdout mov ah,40h int 21h pop ds ; restore our data segment inc word ptr count ; go to next argument jmp main1 main2: mov ax,4c00h ; exit to MS-DOS int 21h main endp b2dec proc near ; convert binary value 0-99 ; to decimal ASCII chrs. ; call with ; AL = binary data ; BX = addr. for 2 chrs. sah ; divide AL by 10, leaving ; AH=quotient, AL=remainder add ax,'00' mov [bx],ah mov [bx+1],al ret b2dec endp _TEXT ends _DATA segment word public 'DATA' count dw 0 ; current command line argument para dw 0 ; total command line arguments psp dw 0 ; save segment of PSP msg1 db cr,lf db 'The command line contains ' db 'xx arguments' msg1_len equ \$-msg1 msg2 db cr,lf db 'Argument ' db 'xx is: ' msg2_len equ \$-msg2 _DATA ends STACK segment para stack 'STACK' dw 64 dup (?) STACK ends end main </pre>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 4: SHOWARGS.ASM is the assembler equivalent of Figure 1.

(let's call it PP.LIB. since we'll be adding more routines to it in future columns) enter the command

```
LIB PP +ARGV +ARGC;
```

Now, to build the executable file SHOWARGS.EXE from the file SHOWARGS.OBJ and PP.LIB, type

```
LINK SHOWARGS, , , PP;
```

When the Linker processes SHOWARGS.OBJ, it notices that it has two unresolved references to the procedures ARGV and ARGC. Since no other object modules are specified in its command line that might satisfy the references, the Linker searches the library, finds modules with names that match what it needs, and incorporates them into the executable program. Once you get used to it, you'll find that making

an effort to write reusable, general-purpose MASM routines and putting them into libraries will save you tons of time and aggravation.

In the next column, I'll discuss environment variable processing in C and MASM programs, and I'll develop some MASM routines that provide counterparts to the C runtime library's services for searching the environment.



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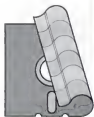


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■ JARED TAYLOR

SPREADSHEET CLINIC



An @function bug in 1-2-3; easy macro debugging; entering long formulas; foreign-language accents by menu; doublestriking F3 for a full-screen range name display.

DEBUGGING MACROS

There are several ways to debug a failing 1-2-3 macro. The most obvious is to use the single-step function to go through it until you find the error. This can take time with a long macro.

Another technique is to put /xq or a blank row after any line in the macro so as to stop execution at a certain point. That way you can run the macro at normal execution speed up to a known point and then check the results. But this, too, takes time, and you have to move the blank row or /xq to a new place if you want to continue checking the macro.

Yet another method is to create ranges part way through a macro and assign macro names (consisting of a backslash and a letter) to them. Then you can start the macro at any of these intermediate points. This is not only time-consuming, however, but it doesn't allow you to run the entire macro through from the beginning. There are some macro errors that are caused by a situation created at the beginning of the macro that is not handled correctly later on. This debugging method might not catch these errors.

I have found that the best solution is simply to insert {?} in the macro wherever I would like to stop it and check results. When you run the macro, it will stop at each of these points and then conveniently restart from the same point as soon as you hit the Enter key. With this technique you can sometimes manage to debug a macro in a single pass.

Ralph D. Sappe
Poughkeepsie, New York

Another advantage of stopping the macro in midstream with {?} is that you can then page through the worksheet to any location so as to check results before you restart with Enter. Of course, if cursor location is important to the continuation of the macro, you must be sure to restore it before you continue.

I use a slight elaboration of the {?} technique when I am using certain 1-2-3, Release 2.0, macro commands. Often the results of these new commands are not displayed until the worksheet is recalculated, so simply stopping execution with {?} may not give a realistic picture. When the macro stops, I can hit F9 (Calc) to get a fresh display of results before I hit Enter to let macro execution continue.

Hitting F9 can be a problem when the spreadsheet is large and takes a long time to recalculate, and I don't want to take the trouble to isolate the macro from the spreadsheet so I can debug it separately. I

can get an update of the display without doing a recalc simply by entering a valid carriage return. The easiest way to do this is to find a blank cell and enter a single character. The screen updates, I examine it for errors, and then hit Enter to continue execution.

BUG IN THE RANGE FUNCTION

There is a bug in the way 1-2-3 handles certain ranges with the @ functions. When you expand a single-cell range into a multiple-cell range, the @ function may lose the range name completely. This is best illustrated by an example.

First, create a worksheet that looks like the first screen in Figure 1. The formulas in line 5 are displayed as text, but enter them as formulas. Set the global column width to about 18. Now give the name RANGE1 to the range A1..A3 and the name RANGE2 to cell B1. Next put the formula @count(range1) in cell A6 and the formula @count(range2) in cell B6. Format the range A5..B6 to text (/Range Format Text) so you will be able to see how the formulas change. Finally, put the formula +A5 in cell A8 and copy it to the range A8..B9, so you can see the values of the formulas in A5..B6. You should end up with a spreadsheet that looks like the second screen.

Now comes the surprise: Redefine RANGE1, changing its contents from A1..A3 to A1. Change the definition of RANGE2 from B1 to B1..B3. What you get is the third screen in Figure 1, which is certainly not what you expected. Column A is fine, but the @count formulas in column B have lost RANGE2 as their argu-

■ There is a bug in 1-2-3. When you expand a single-cell range into a multiple-cell range, the @function may lose the range name completely.

■ SPREADSHEET CLINIC

A		B	
1	5		1
2	10		
3	15		
4			
5	@COUNT(A1..A3)		@COUNT(B1)
6			
7			
8			
(FIRST SCREEN)			
A		B	
1	5		1
2	10		
3	15		
4			
5	@COUNT(RANGE1)	@COUNT(RANGE2)	
6	@COUNT(RANGE1)	@COUNT(RANGE2)	
7			
8	3		1
9	3		1
(SECOND SCREEN)			
A		B	
1	5		1
2	10		
3	15		
4			
5	@COUNT(RANGE1)	@COUNT(B1)	
6	@COUNT(RANGE1)	@COUNT(B1)	
7			
8	1		1
9	1		1
(THIRD SCREEN)			

Figure 1: Inconsistencies in 1-2-3's range function.

ment and now refer only to B1. RANGE2 is supposed to include B1..B3, not just a single cell. If you put a number in cell B2, the @count values in cells B8 and B9 don't change to 2, as they would if the formulas in B5 and B6 really referred to RANGE2.

It's not only the @count function that drops the range name. Any time you expand a single-cell range name into a multiple-cell range name, all @function arguments that had the single-cell range name are converted incorrectly to the actual original single-cell address (in this case B1). So don't ever use /Range Name Create to convert a single-cell named range into a multiple-cell range. The new, expanded range will be perfectly valid for new references to it, though. If you enter a new @count(range2) formula somewhere in the third screen, it will refer to cells B1..B3 as it should.

There are more surprises. Goto cell A5 and hit Edit (F2), but don't hit Enter or an arrow key. The argument in the formula is a single-cell range, A1..A1, which is supposed to be impossible. (If you can show me any other way to get the argument of a function to appear as A1..A1, I'll eat my hat.) Hit Esc to leave A5 as it was. If you now expand RANGE1 back to include A1..A3, you'll see that A5 and A6 don't dump the range name from the argument and give you a reference to a single cell, as the formulas in B5 and B6 did. That's because of that A1..A1 argument. If you had gone to A5 and hit Edit (F2) and then Enter, you would have collapsed the argument to A1, and the expansion of RANGE1 would have given you the same muddled error I mentioned earlier.

Kevin Gaza
Valparaiso, Indiana

Both Releases 1A and 2.0 have the same nasty bug. Fortunately, most of us don't often have to expand a single-cell range.

INTERNATIONAL CHARACTERS

In the Spreadsheet Clinic of April 28, 1987 (Volume 6 Number 8), I was pleased to find a submission that offered a way to include international characters in 1-2-3 without using cumbersome compose sequences. The same thing can be done by using a menu, as outlined in Figure 2. As shown, six different international characters can be selected, but you can, of course, have as many as eight. I have used numbers in the top line of the menu, since that lets you make a selection by typing a character rather than having to move the cursor and hit Enter. To get the letters into the menu to begin with, you must use the 1-2-3 compose sequence. In the figure, \A and CHARACTER are the range names of the cells to their right.

You can run the macro and make a

\A		{MENUCALL CHARACTER}					
CHARACTER	1a	2a	3c	4b	5b	6b	
	a	ä	ç	é	è	ê	
	à	â	ç	ë	ö	û	

Figure 2: A menu that lets you select international characters without the bother of going through the 1-2-3 compose sequence.

■ I found a way to include international characters in 1-2-3 without using cumbersome compose sequences.

menu selection at any point at which it is legal to type a label. This includes creation and deletion of range names, as well as range names used after the Goto (F5) key. You can also run the macro repeatedly within the same label, if you need more than one accented character. The macro will even work while you are in INPUT mode.

Mike Avon
Waterloo, Ontario
Canada

This is a simple and interesting solution to the problem of compose sequences. It's also edifying to see how 1-2-3 handles accented characters internally. For example, the characters in the second line of the menu are supposed to be displayed in the second line of the control panel as you move the cursor along the top line of the menu. However, 1-2-3 usually displays the default, standard-ASCII character in the second line rather than the accented character. I think this is distracting, so I would leave the second line of the menu blank. That way, when you move the cursor, the second line stays empty. Of course, since Mr. Avon has cleverly included a number as the beginning character of each menu choice, you don't have to move the cursor at all.



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PRODUCTIVITY

■ SPREADSHEET CLINIC

	C	O	E	F
3		07-Dec-81	<=	DATE(41,12,1)
4				
5		Sunday		
7		Formula in cell D5:		
8		=CHOOSE((WEEK(D5),),"Saturday","Sunday","Monday","Tuesday","Wednesday","Thursday","Friday")		
10				

Figure 3: A 1-2-3 formula that displays the day of the week.

DAYS OF OUR LIVES

The Spreadsheet Clinic of June 9, 1987 (Volume 6 Number 11), showed a way to have 1-2-3 find the day of the week corresponding to a date. That method works, but if you have Release 2 there's a simpler way. The formula in cell D5 of Figure 3 uses @choose and @mod to display the day of the week directly. The @mod function divides the date serial number by seven and returns the remainder, a number from 0 to 6. Since January 1, 1900 (the day 1-2-3's internal calendar begins), was a Saturday, 0 is Saturday, 1 is Sunday, and so on. The @choose selects the proper day based on the value of @mod(\$D5,7).

Scott Strehlow
Oshkosh, Wisconsin

Several readers sent in this handy formula, but Mr. Strehlow's letter arrived earliest.

LONG FORMULAS

In Spreadsheet Clinic of October 28, 1986 (Volume 5 Number 18), a reader mentioned several ways to compact long formulas to fit into a cell. (The limit for most spreadsheets is 240 characters.) He sug-

■ If you use /Range Name Create (or Delete), you'll get a list of range names in the control panel.

gested sticking to cell references in the A to Z range, because they take up fewer characters than AA, AB, etc.

I have another suggestion: use single-letter range names instead of cell addresses. +A+B is a much shorter formula than

+C36+D142. If you need absolute references, you can always write +\$A+\$B.

Quek Kwang Chye
Singapore

There actually is a way to get around the 240-character limit, as I explained in my comments on the original submission. It's more of a trick than a solution, however, and Mr. Quek's technique is easier.

GETTING TO A RANGE

A lot of people realize that if you hit the Goto (F5) key in 1-2-3 and then hit the Name (F3) key, you'll get a display of spreadsheet range names in the display panel. But look what happens if you hit F3 twice: you get all of your range names in a full-screen display. Highlight the range name you want, hit Enter, and go right to the range.

Marshall Durbin
Guymon, Oklahoma

You'd think Lotus would document a handy fact like that, but I couldn't find it described anywhere. If you use /Range Name Create (or Delete), you'll also get a list of range names in the control panel. Here, too, if you hit F3 you'll get a full-screen display of names. Now if you hit F3 again, you can toggle between full-screen and control-panel displays. This is one more nice feature that slipped past the documentation writers.

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■ PAUL SOMERSON

USER-TO-USER

A powerful utility that can remove all files in a subdirectory and the subdirectory itself in one step, but that respects protected files and can run without user intervention.

ZAPPING DIRECTORIES

How many times have you attempted to remove a subdirectory and seen "Invalid path, not a directory, or directory not empty" appear on the screen instead?

DOS has limitations when it comes to removing files. It lacks a utility that in one step deletes all of the files in a specified directory and then removes the directory. RFD.COM (Remove Files and Directory), created by RFD.ASM in Figure 1 or RFD.BAS in Figure 2, does this while also allowing batch execution, and it reports on

the success or failure of the process.

RFD operates in two modes, an interactive one and a batch mode that can be run from a batch file without any annoying messages. The syntax is

RFD [d:] path [/Y]

In interactive mode the program asks the user whether or not to proceed. Specifying the '/Y' option on the command line bypasses the prompt (automatic response) and suppresses the display of the result

messages. RFD will, of course, tell you what happened. It returns a result code so that the result of the program can be processed with ERRORLEVEL. In batch mode, all messages to the screen are suppressed. To put RFD into batch mode just use the '/Y' switch on the command line. When you run your batch file, you will not get any screen output and you don't have to be around to answer questions.

RFD terminates with return codes that may be tested with IF ERRORLEVEL subcommands during batch file execution.



```

;-----
; Program : RFD.ASM
; Programmer : J. Stephen Redmond
;
; Syntax : RFD [d:] path [/Y]
; Description : RFD removes the files and subdirectory specified by the
; path argument on the command line. RFD has two modes of
; operation: 1) default command line mode, 2) batch mode.
; 1) Default - warning is issued and user must respond
; to proceed (see Warning Message).
; 2) Batch - specify '/Y' argument on command line.
; No warning will be issued and program will
; attempt to remove directory.
; Both modes of operation leave an ERRORLEVEL code upon
; termination as follows:
; 00 - Syntax Error
; 08 - Operator Terminated
; 9 - Protected File(s) in sub-dir
; 2 - Path Not Found
; 0 - Successful Completion
;-----

Code segment para public 'code'
assume cs=code

org 0100h
; .COM file, 0x0100h

Begin:
  jmp start
  db "© 1987, Ziff-Davis. By J. Stephen Redmond"
  db "*** WARNING *** All Files Will Be Deleted '13,18"
  db "Do You Wish to Proceed (Y/N) ? "
  db "Syntax : RFD [d:] pathname [/Y] 13,18,"' ; Srvl 08
  db "Program Terminated by Operator 13,18,"' ; Srvl 08
  db "Protected File in Subdirectory 13,18,"' ; Srvl 08
  db "Specified Path Not Found 13,18,"' ; Srvl 08
  db "13,18,"'

Pathname
  db 84 dup (?)
  db "13,18,"'

Wildcards
  db 1

Operator_Sw
  db 1

start
  proc near

```

```

cld
mov ax, 00h
mov ax, byte ptr [ax] ; point to Path name length
cmp cl, 4
jnz File_01
mov ax, 09
jmp Rfd_Error

File_01:
  sub cl, 1
  mov cx, 05h
  push cx
  push cx
  mov ax, 01h
  mov ax, 02h
  repne scasd
  jncx Prompt

  ; do not include leading space
  ; save high half
  ; save length of pathname
  ; search for switch indicator
  ; start search here
  ; save the string
  ; on switch, ask user if ok

  byte ptr [di], 00h ; capitalize switch
  byte ptr [di], 'Y' ; is it the Y switch
  jmp Prompt
  ; yes, skip prompt
  ; get length of pathname
  ; adjust for switch length
  ; save adjusted length
  ; set to batch mode

Prompt:
  mov dx, Question
  mov ah, 9
  int 21h
  mov ah, 1
  ; service 1 - wait for key press
  ; and display it
  and al, 00h
  cmp al, 'Y'
  jnz Path_01
  mov ax, 08h
  jmp Rfd_Error

Path_01:
  ; get path length
  ; save it again
  ; start move here
  mov ax, 02h

```

(continues)

Figure 1: RFD.ASM, a code that creates the RFD.COM utility to remove both the files in a subdirectory and the subdirectory itself.

■ USER-TO-USER

```

lea di, Pathname      ; address of storage
movsb                 ; move the pathname
byte ptr [di], 0       ; onto pathname ASCII
lea dx, 0x4           ; set disk transfer address
mov ah, 1ah           ; Function 1A - set dta
int 21h

pop bp                ; get length pathname
push bp               ; save it again
lea si, wildcard       ; source string
lea di, pathname[bp]   ; destination string plus offset
mov cx, 5              ; byte count for move
repzsb                 ; move in wildcard

lea dx, Pathname       ; address pathname and wildcard
mov cx, cx              ; move attribute
mov ah, 4bh            ; Function 4B - Find First File
int 21h
cmp al, 2              ; files not found
je remove

delete:
lea si, dta[30]         ; this is where filename is stored
mov cx, 40h            ; max. 13 chrs
lea di, Pathname[bp+1] ; where filename after the '\
repzsb                 ; move the filename in
lea dx, Pathname        ; full filename - local path
mov ah, 41h            ; Function 41 - Unlink - delete file
int 21h
cmp al, 5              ; AL= 5 here means protected file
je rtd_exit

mov ah, 4fh            ; Function 4F - Next matching file
int 21h
cmp al, 1B             ; no more files found
jne delete

remove:
pop si                 ; length of pathname
mov Pathname[si], 0     ; onto it an ASCII pathname again
lea dx, Pathname

```

```

mov ah, 3ah            ; service 3A - readir
int 21h

rtd_exit:
cmp opcode[bp], 0      ; 0 = batch mode, 1 = Command mode
je batch_mode
push ax                ; save error code from processes
lea dx, crlf            ; cart line as display
mov ah, 9              ; service 9 - print string
int 21h
pop ax
cmp al, 69             ; runtime error code
lea dx, 00             ; Error 69 - Incorrect system
jmp Print

err:
cmp al, 66             ; Error 66 - User Terminated
je dx, 00
cmp al, 6a             ; Error 6A - Invalid function
je Print
cmp al, 5              ; Error 5 - Protected files
je dx, 00
cmp al, 3              ; Error 3 - Path not found
je batch_mode
lea dx, 00
jmp Print

Print:
push ax                ; save error code
mov ah, 9              ; service 9 - print string
int 21h
pop ax
push ax                ; save error code
mov ah, 4Ch            ; service 4C - Exit with Code
int 21h

start:
mov dx, 0
label byte             ; to store disk data
endb
code
end begin

```

(Figure 1 ends)

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■ USER-TO-USER

delete all of the files in the current directory. This is easier than typing DEL *.* and then having to type Y, or using KEY-FAKE (*PC Magazine*, Volume 4 Number 26) to simulate the response. Note: When you use the /Y option, be absolutely certain that you have entered the correct directory and drive. (Thank goodness for Peter

transfer disk information to memory. RFD uses interrupt 21h functions 4E and 4F to access the DTA for data storage and retrieval. On entry to a .COM program the default DTA is set to hex 80, which is also the same area used by the PSP (Program Segment Prefix).

The PSP contains information about the arguments that were entered on the command line. The reason for changing the DTA to the end of the program is purely personal, because the information that we need from the PSP has already been extracted at this point in the program.

The pathname is concatenated with the filename wildcard's string, which will be used to delete the files in the specified directory. Function 4E (Find First Matching File) is used to retrieve the first filename from the directory. If no file is found (error code from 4E, AL=18) the program starts removing the directory.

If a file is found, function 4E returns the following information to the current DTA:

```
21 bytes - reserved by DOS for function 4F
1 byte - file attribute
2 bytes - file's time
2 bytes - file's date
2 bytes - file's name, low word
2 bytes - file's name, high word
13 bytes - filename followed by a byte of zeros.
```

The 13 bytes of the filename, at offset 30 from the DTA, are used to construct the complete path and filename. The address of this ASCII name is passed to function 41 (Delete a File). If the delete request is not successful the program exits.

If the deletion is successful, the program issues a function 4F (Find Next Matching File) and the delete process is repeated if there are more files. When there are no more files, the program tries to remove the subdirectory.

The pathname is adjusted to reflect the original request, and function 3A (Remove Directory Entry) is used to remove the subdirectory. If the current directory is the requested directory, function 3A returns a 5 in AL (access denied). I didn't test for AL = 5 here, so the program will not terminate because of the error code.

Now here's the part I like: communicating with the environment. DOS service 4C lets programs set an ERRORLEVEL code when they terminate. You can use this technique and a simple batch file test to check on the status of a program's execu-

■ When you use the /Y option, be absolutely certain that you have entered the correct directory and the proper drive.

Norton!) RFD, like the RD command, will not allow you to remove the root directory, nor will it delete the files therein.

A subdirectory is a special filename in a directory where the information pertaining to other files is stored. Before DOS will allow the deletion of a subdirectory, it checks to see if the subdirectory has any entries (files). If the subdirectory is empty, it may be deleted. If not, all entries must be eliminated prior to deleting the subdirectory. RFD does this task in one step.

RFD scans the command line for the switch indicator in order to see whether or not it's in batch mode. Once the mode has been established, the requested pathname and its length are noted and stored. (Command line parsing was kept to a minimum, and as a result RFD does not trim any leading blanks from the requested pathname.)

The test for four characters on the command line was the easiest way to eliminate the possibility of removing the root directory. If you try to use the root directory as the pathname, RFD will issue a syntax error. If you try to place a blank before the \ to bypass this feature, you'll get a "Path Not Found" error.

The program code contains a request to function 1A (Set a New DTA). DTA is short for Disk Transfer Address and it is used by DOS as a depository (buffer) to

tion. The batch file uses a cascade of IF ERRORLEVEL tests to see what code the program set and to echo appropriate messages to the screen. Figure 3 contains a batch file, called RFDTEST.BAT, which tests to see what RFD did.

J. S. Redmond
Calgary, Alberta
Canada

RFD isn't perfect, but it really comes in handy when you're cleaning up or concatenating subdirectories. Its ability to work silently and without intervention in batch mode but demand a user's answer in direct mode is just what the doctor ordered. And to top it all off, the program will generate

```

RFD> OFF
RFD> N? N?
IF ERRORLEVEL 90 GOTO ERR
IF ERRORLEVEL 10 GOTO ERR
IF ERRORLEVEL 5 GOTO ERR
IF ERRORLEVEL 3 GOTO ERR
IF ERRORLEVEL 2 GOTO ERR
IF ERRORLEVEL 1 GOTO ERR
IF ERRORLEVEL 0 GOTO SUCCESSFULLY_COMPLETED
GOTO END
:ERR
ECHO Syntax Error
GOTO END
:SUCCESSFULLY_COMPLETED
ECHO operator Terminated
GOTO END
:END
ECHO Protected Files
GOTO END
:END
ECHO Path Not Found
GOTO END

```

Figure 3: RFDTEST.BAT, which uses IF ERRORLEVEL to test return codes generated by the RFD.COM file and subdirectory remover.

return codes so batch files can take appropriate steps based on what happened (or didn't happen). Too bad all utilities don't do this.

Be very careful in using RFD with the /Y option. It won't delete a subdirectory that contains another subdirectory. You must use RFD to delete the lowest-level (farthest from the root) subdirectories first and then move up the tree.

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■ EDITED BY CRAIG L. STARK

POWER USER

Transmitting WordPerfect underlines over modem lines; envelope style sheet for Microsoft Word; dating and recycling dBASE records; easy-to-reach WordPerfect key assignments.



FUNCTIONAL DATING

I encountered a curious problem when upgrading from dBASE III to III Plus. The former lets me

```
SET FUNCTION 2 TO DTOC(DATE())
```

in order to date records rapidly. However, dBASE III Plus chokes when filling a GET with F2 SET this way.

Apparently, it's the slashes that Plus finds indigestible. When the character string "07/04/87" is fed into a GET from the function key, the field ends up as "07/00/04"—an impossible date that dBASE rejects. Data entry stops until the error is corrected. I solved the problem with

```
SET FUNC 2 TO J
STUFF(STUFF(DTOC(DATE()),6,1,""),3,1,"")
```

This removes the slashes, leaving "070487". If your eyes glaze over at a nested four-argument function with two embedded functions, another way to write this same coding is

```
noslash=DTOC(DATE())
noslash=STUFF(noslash,6,1,"")
SET FUNC 2 TO STUFF(noslash,3,1,"")
```

Joe Mirsky
Mohegan Lake, New York

Mr. Mirsky is right: my brain also groans at that double STUFF line. There is still a third way to extract the slashes so a Function Key can enter a date:

```
SET FUNC 2 TO SUBS(DTOC(DATE()),1,2);
+SUBS(DTOC(DATE()),4,2);
+SUBS(DTOC(DATE()),7,2)
```

The response of dBASE III Plus when slashes are entered as part of a date field is

annoying. It chokes on them whether entered manually or through the function keys. And only Plus rejects the slashes: dBASE III, FoxBASE Plus, and Clipper all allow either "070487" or "07/04/87" to be entered in GETting or BROWsing a date field. I hope Ashton-Tate will put this on their list for a future upgrade.

—Brad Stark

THE FINISHING TOUCH

Flush-left dBASE programs run faster than indented code because the dBASE interpreter reads every byte before processing

the line. But if you have to go back later to change something, the flush-left coding is a nightmare to read. The FINISH.PRG, shown in Figure 1, solves this dilemma: you can use it to strip indents on finished programs or put them back again later.

Before using FINISH.PRG, you must create a scratch file, TEMP.DBF, containing only one field: line, character type, width 80. FINISH.PRG begins by asking you to specify the filenames of the source and output programs (don't add the .PRG extension—it's done for you). You may use the same filename if you wish. Next,

```
*** FINISH.PRG
CLEAR
SET SAFE OFF
ACCE 'Enter input filename ' TO infil
ACCE 'Enter output filename ' TO outfil
WAIT '<E> Strip, <I> Indent ' TO which
IF .NOT. FILE('temp.dbf') .OR.
? 'Error: file not found'+CHR(7)
CANCEL
ENDIF
?
? "Working...Please standby"+CHR(10)
USE temp
* temp.dbf has 1 field: Line,C,#
RAP
APPE FROM infil..prg SDP
SET TALK OFF
GO TO
SET ALTE TO soutfil..prg
SET ALTE ON
*SET CONS OFF

IF UPFE(whicb)="S"
* Strip:
DO WHILE .NOT. EOF()
? LTRIM(TRIM(line))
SKIP
ENDDO
ELSE
*Re-indent:
inc=2
tab=8
DO WHILE .NOT. EOP()
rec=LTRIM(UPFE(line))
IF .NOT. (LEN(rec)=8.OR.rec="")
DO CASE
CASE SUBS(rec,1,4)$END1,END0,ENDC=
tab=tab-1
CASE SUBS(rec,1,4)$ELSE,OTHE,CASE"
? SFAC((tab-1)+inc)
*LTRIM(TRIM(line))
SKIP
LOOP
ENDCASE
ENDIF
? SFAC((tab+inc)+LTRIM(TRIM(line))
IF rec="IF " .OR. rec="DO WHILE"
.OR. rec="DO CASE"
tab=tab+1
ENDIF
SKIP
ENDDO
ENDIF
*SET CONS ON
SET ALTE TO
SET TALK ON
SET SAFE ON
USE
? CHR(10)+"Finished."+CHR(7)
? CHR(10)+"Finished."+CHR(7)
```

Figure 1: You can run dBASE programs through FINISH.PRG either to strip indents and comments or to reindent them later.

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■ POWER USER

tell FINISH whether you wish to strip or reindent.

The program begins by ZAPping TEMP.DBF to remove any previous records and then appends the incoming program file into TEMP.DBF. Because your program is in ASCII text, the SDF switch is used. In effect, TEMP.DBF becomes a temporary database with one record for each program command line. After processing, each record is output to an ASCII text file using dBASE's SET ALTERNATE TO command. Note that I have commented out the SET CONSOLE ON/OFF lines for maximum speed. Just remove the * if you want to display the output as it is produced.

The stripping routine takes essentially the same approach as the one that appeared in Power User, Volume 5 Number 20, but here it is applied to dBASE code lines instead of memory variables. The outer DO WHILE loop processes one record (code line) at a time. The inner DO WHILE indexes right one byte at a time until it finds the first nonspace, then outputs the line starting at that byte.

The indenting routine looks for dBASE keywords that require indentation. When these are found at the start of a line, a memvar ("tab") is either "pushed" or "popped" by one. The value of tab times a constant ("incr") is the total indent, and the SPACE() function is used to concatenate this indent onto the front of each line. I've used a value of 2 for this constant, but you can set it to your own taste.

The indent routine can also be used as a simple debugging tool. If a program has any open loops, extraneous ifs, Endifs, etc., the output will show obvious indentation errors. It would be rather easy to modify FINISH.PRG to detect and flag these errors.

Jeffrey Mack
Naperville, Illinois

Actually, an even faster stripping program called dCRUNCH.COM was published here in Volume 5 Number 13. However, dCRUNCH cannot reindent a program, and it's a great convenience to have both these complimentary routines at your fingertips in one package.

I took the liberty of revising Mr. Mack's program for dBASE III Plus to take ad-

vantage of the new `LTRIM()` function. If you have not upgraded to III Plus, two modifications will be needed. First, the `LTRIMs` in the reindent section can be removed altogether—the tradeoff is that the reindenting fails if your source file is not, in fact, flush-left to start with. Second, in the stripper, replace the simple `LTRIM` output line with the following loop:

```
ref=1
DO WHILE SUBS(line,ref,1)=' ';
  .AND. ref<LEN(TRIM(line))
  ref=ref+1
ENDDO
```

[Note: we have broken the above `DO WHILE` into two lines to fit the magazine's margins. To avoid a syntax error when running it, remove the semicolon and combine the two lines into one—Ed.]

Additional variations are possible. Since the purpose of reindenting the program is to work on it, you could print it out at the same time by adding `SET PRINT ON` next to the `SET CONS OFF` command. (Remember then to `SET PRINT OFF` at the end.) For fastest `dBASE` execution, the stripper could be modified to remove blank lines by surrounding the inner `DO WHILE` loop with

```
IF LEN(TRIM(line))>0...ENDIF
```

Code lines commented out with an `***` could be stripped by surrounding the output line with

```
IF .NOT. LTRIM(line)=""...ENDIF
```

in `dBASE III Plus`, or with

```
IF .NOT. SUBS(line,ref,1)=""...ENDIF
```

in `dBASE III`.

If you're using `dBASE II`, you'll have to replace the output lines, which use the `SPACE()` function, with `DO WHILE` loops.

One final caution: If you use program lines longer than 80 characters, you must increase the width of the field "line" in `TEMP.DBF`. Otherwise the lines get truncated.—Brad Stark

FORMATS

Standard *WordPerfect* procedure is simple: start typing. You don't have to name the file until you save the document. [WordPerfect could save new users hours

```
<Ctrl-F10><Alt-F>
<Shift-F10>
(subdirectory name)
<Ctrl-PgUp><CR><CR>
.FMT<CR>
<F10><Ctrl-End><CR>
<Ctrl-F10>
```

```
Define macro Alt-F
Retrieve a file
Start with its subdirectory
Let user key in its name
Add the .FMT extension
Now forget the name
End macro definition
```

Figure 2: A *WordPerfect* formatting macro.

of fruitless searching for instructions on how to open a new file if they would just tell people that—Ed.) Ideally, formatted documents should follow a similar pattern: choose your format and go.

Mitt Jones (Power User, Volume 6 Number 10) has the right idea—use format files and add a macro to retrieve them. With his `FORMATS` macro, however, you need a document name before you can start entering text.

My practice is to put all the format files in the same subdirectory so I always know where they are. I give them all an eight-letter format name with the extension `.FMT` so I always know what they are. Then I use the macro shown in Figure 2. Then hit `Alt-F` (F for Format), type the format name, hit Enter, and you've got it.

John Kneisly
Ohio Wesleyan University
Delaware, Ohio

The macro line labeled "Now forget the name" is important. Without it, you might accidentally save your current document on top of the format file. I'm adding this clever tip to my own arsenal right away.—Neil J. Rubenking

OTHERKEY

One of *WordPerfect's* best-kept secrets is that you can access a number of its functions with `Alt`-key combinations. For a touch typist, most of these alternatives permit faster editing than do the normal function-key commands. Your hands do not leave the alphanumeric rows nearly as often, and in some cases the `Alt`-keys require fewer keystrokes.

Since the *WordPerfect* manual mentions none of these, I compiled "Key Combinations for *WordPerfect*" by trial and error. Therefore, the list may be incomplete. However, all the key combina-

tions do work perfectly in *WordPerfect* 4.1 and 4.2, and on PC compatibles from three different manufacturers that I regularly use. The left-hand column gives the alternate key combination, while the right-hand column lists the function and the regular key strokes.

Ian M. Richmond
London, Ontario
Canada

For the most part, these key assignments are left over from *WP*, Version 3. They are

Key Combinations for WordPerfect

Editing Functions:

- Alt-1 = Cancel/Undelete (F1)
- Alt-2 = Subscript (Shift-F1-2)
- Ctrl-2 = Superscript (Shift-F1-1)
- Alt-3 = Directory (F5)
- Alt-4 = Print Format (Alt-F8)
- Alt-5 = Spell-checker (Ctrl-F2)
- Alt-6 = Define Macro (Ctrl-F10)
- Ctrl-6 = Execute Macro (Alt-F10)
- Alt-7 = Retrieve Document (Shift-F10)
- Alt-8 = Save Document (F10)
- Alt-9 = Move/Retrieve Text (Ctrl-F4)
- Alt-0 = Block On/Off (Alt-F4)

Cursor Movement/Delete Text:

- Ctrl-X = Cursor Right (Right Arrow)
- Ctrl-Y = Cursor Left (Left Arrow)
- Ctrl-W = Cursor Up (Up Arrow)
- Ctrl-Z = Cursor Down (Down Arrow)
- Ctrl-I = Insert Tab (Tab)
- Ctrl-J = Hard Return (Enter)
- Ctrl-K = Delete to end of line (Ctrl-End)
- Ctrl-L = Delete to end of page (Ctrl-PgDn)

■ POWER USER

handy, without a doubt. But don't get too dependent on them—there's no guarantee they'll work in the next version.

—Neil J. Rubenking

ENVELOPES WITH STYLE

Microsoft Word users can take advantage of style sheets to print the inside address of a letter directly onto an envelope. The trick is to keep two style sheets—one for printing the letter and one for printing the envelope. The formatting codes for the letter style sheet can be defined as needed, using, for example, the codes DA for Date, IA for Inside Address, SA for Salutation, and so forth. To create the envelope style sheet, go to the Gallery and use the Format Character option to change all the style codes except Inside Address (IA) to hidden text. Next, match the Division Standard margins to your envelopes, leaving a top margin that will center the address vertically on the envelope and a left margin that will center the address horizontally. (You may also want to adjust the margin for the Inside Address style code.) Finally, save the style sheet using the Transfer Save command.

Once both style sheets are created, you can write, save, and print your letters as usual, attaching the letter style sheet and using the proper style sheet codes for each portion of the letter. Next attach the envelope style sheet using Format Style Sheet, and print the envelope. Do not save the letter after printing the envelope, or it will be saved with the envelope style sheet attached.

Mitch Schwartz

Port Washington, New York

This extremely useful trick is a good example of the value of Word's style sheets. When using it, just be sure to set your Window Options so that hidden text is not visible.—M. David Stone

UNDERLINING IN WP

I like to underline words in documents, but the underline attribute can easily get lost when I convert to another format. For example, if I want to transmit a WordPerfect document via MCI Mail, I must first save it as a plain text file without any formatting codes. My solution is to replace the [U] and [u] (Begin underline and End under-

```
<Ctrl-F10><Alt-U>
<Home><Home><Up>
<Alt-F2>N
<F8><F8><Left><BKS><F2>
<F8><F8><Left><BKS> _ <F2>
<Home><Home><Up>
<Alt-F2>N
<F8><F2>
<F2>
<Ctrl-F10>
```

Define the macro Alt-U
Start at the very top
Search and replace w/o confirm
Search for a [u] code
Replace it with a " _ " and a [u]
Back to the top
Search and replace w/o confirm
Find any [U] code
Replace it with an underbar
End the definition

Figure 3: A WP macro to replace underline codes with underline characters.

line) codes with a single underbar character " _ ". Of course, this assumes I'm not using the underbar character anywhere else in my document.

The macro to accomplish this replacement isn't completely obvious. It's shown in Figure 3. I call it Alt-U for Underline.

The trick in using the macro is that you have to press the Underline key <F8> twice and then delete the first of the two. That lets you search for the [u] code. In that first search-and-replace, you simply add the underbar without removing the [u]. The second pass replaces all [U] codes with an underbar. When you remove the [U] codes, the [u] codes disappear.

My thanks to the WordPerfect Support Group for helping me work this one out. You can reach the WPSG on CompuServe (GO WPSG) or by writing to WordPerfect Support Group, P.O. Box 1577, Baltimore, MD 21203.—Neil J. Rubenking

RECYCLING

Phillip M. Barber's idea for recycling dBASE records (Volume 6 Number 2) is so useful that I made a generic routine for emptying out the contents of a previously used record.

The code in Figure 4 assumes you have already verified that all that fields should be cleared for the record to be recycled. Note that you pass one parameter (the number of fields) when the procedure is called, so the syntax is

```
DO recycle WITH <field count>
```

Though the generic procedure is slower than hard-wiring the REPLACE statements, it is certainly easier, especially if you have many fields to replace.

Larry L. Ellenbecker
Appleton, Wisconsin

```
PROC recycle
PRIV fno,cfn,fname
PARA fno
cfn=1
DO WHILE cfn<=fno
fname=FIELD(cfn)
DO CASE
CASE TYPE(fname)="C"
REPL &fname WITH " "
CASE TYPE(fname)="N"
REPL &fname WITH 0
CASE TYPE(fname)="L"
REPL &fname WITH .F.
CASE TYPE(fname)="D"
REPL &fname WITH CTOD("")
ENDCASE
cfn=cfn+1
ENDDO
```

Figure 4: A dBASE procedure for recycling deleted records.

Recycling is much faster than deleting, packing, reindexing, and appending. If you're using dBASE, however, Mr. Ellenbecker's procedure is rather slow—on my Compaq 286, it took 5 seconds to clear out a 50-field record (1,500 bytes in length). The procedure becomes much more practical in faster programs, such as Fox-BASE or Clipper.—Brad Stark

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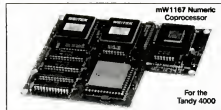
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■ EDITED BY ROBERT L. HUMMEL

LANGUAGES

A Turbo Pascal program that gets a handle on 255 open files; a BASIC program that upgrades your PC to an Etch A Sketch; and high-intensity backgrounds on mono screens.

BASIC

CREATING GRAPHICS SCREENS

I spend a lot of time developing graphics and short games for my kids but get impatient with all the trial and error that's usually required. I wrote DRAW.BAS (Figure 1) to let me quickly create graphics screens, draw lines and circles, and plot points. Besides serving as an "Etch A Sketch" type program, DRAW.BAS also creates a BASIC program file to reproduce the various commands that were entered. By merging the generated code into your programs, the graphic image may be recreated using a single GOSUB command.

Ralph Staus
Mohrsville, Pennsylvania

DRAW.BAS accepts a number of commands that allow you to draw lines and circles. The arrow keys move the cursor in single-pixel increments around the screen, and the Shift-Arrow keys go in steps of ten. To begin drawing a line at the current cursor position, type an L. Then move to where the line is to end and press E. Circles are created by placing the cursor at the center and typing C, and then putting the cursor at the radius and pressing R. The Plus and Minus keys mark and unmark individual points, respectively.

With only a few changes this program could do a lot more; for example, function keys could be used to choose colors, and regular character keys could be used to enter text. SCREEN 9 will work only with an EGA video adapter—change it to SCREEN 2 for a CGA.—Ethan Winer

```

5 ***** DRAW.BAS
10 CLS : OPEN "O", #1,"FILE.BAS"
15 N = 10
20 PRINT #1, STR$(N) : " SCREEN 9"
30 MX = 720 : MY = 340 : AY = .705
40 A = 7 : F = -1 : CS = " " : LS = " " : RS = " "
50 SCREEN 9 : X = MX / 2 : Y = MY / 2
60 AS = INKEYS
70 A = -7 * (A = 0) : PRESET (X, Y), A
80 IF LS < " " THEN FSET(LX, LY), A
90 IF RS < " " THEN FSET(RX, RY), A
100 FOR I = 0 TO 255 : NEXT
110 IF AS = " " GOTO 60
120 IF AS = CHR$(27) THEN SCREEN 0 : CLOSE : END
130 IF AS = CHR$(8) + "H" THEN DX = 0 : DY = -AY : GOTO 290
140 IF AS = CHR$(8) + "K" THEN DX = -1 : DY = 0 : GOTO 290
150 IF AS = CHR$(8) + "M" THEN DX = 1 : DY = 0 : GOTO 290
160 IF AS = CHR$(8) + "F" THEN DX = 0 : DY = AY : GOTO 290
170 IF AS = "H" THEN DX = 0 : DY = -10 * AY : GOTO 290
180 IF AS = "K" THEN DX = -10 : DY = 0 : GOTO 290
190 IF AS = "M" THEN DX = 10 : DY = 0 : GOTO 290
200 IF AS = "F" THEN DX = 0 : DY = 10 * AY : GOTO 290
210 IF AS = "L" OR AS = "I" GOTO 330
220 IF AS = "E" OR AS = "R" GOTO 340
230 IF AS = "R" OR AS = "C" GOTO 360
240 IF AS = "C" OR AS = "R" GOTO 370
250 IF AS = "E" THEN N = N + 10 : GOTO 420
260 IF AS = "L" THEN N = N + 10 : GOTO 440
270 IF AS = CHR$(8) + "G" THEN DX = -1 * X : DY = -1 * Y : GOTO 290
280 IF AS = CHR$(8) + "O" THEN DX = -1 * X + MX/2 : DY = -1 * Y + MY/2 : GOTO 290
290 IF P = 1 THEN FSET(X, Y) ELSE PRESET(X, Y)
300 Y = Y + DY : IF Y < 0 THEN Y = 0 ELSE IF Y > MY THEN Y = MY
310 X = X + DX : IF X < 0 THEN X = 0 ELSE IF X > MX THEN X = MX
320 P = POINT(X, Y) * 2 - 1 : GOTO 60
330 LS = " " LINE(" + STR$(X) + " + STR$(Y) + " : LX = X : LY = Y : GOTO 60
340 N = N + 10 : PRINT #1, STR$(N) : LS = " " : STR$(Y) " "
350 LINE(LX, LY) - (X, Y) : LS = " " : GOTO 60
360 RS = " " : RX = X : RY = Y : IF CS = " " GOTO 60 ELSE GOTO 390
370 CS = " " CIRCLE(" + STR$(X) + " + STR$(Y) : CX = X : CY = Y
380 IF RS = " " GOTO 60
390 R = SQR((RX - CX) * (RX - CX) + (RY - CY) * (RY - CY) * 2)
400 N = N + 10 : PRINT #1, STR$(N) : CS = " " : RS STR$(R) : CIRCLE(CX, CY), R
410 RS = " " : CS = " " : GOTO 60
420 PRINT #1, STR$(N) : FSET(" STR$(X) " + STR$(Y) " )
430 P = -1 : P : GOTO 60
440 PRINT #1, STR$(N) : PRESET(" STR$(X) " + STR$(Y) " )
450 F = -1 : F : GOTO 60

```

Figure 1: A graphics drawing program that also generates BASIC programs.

■ LANGUAGES

TURBO PASCAL

HANDLES

The DOS 3.1 manual says you may have up to 255 files open at one time by changing the FILES=xx statement in the CONFIG.SYS. However, any one process can really only open at most 20 files, and DOS takes over 5 of those.

DOS puts a copy of the pointer to the file handle table and an integer containing the size of the table into the Program Segment Prefix (PSP) at offset 32 Hex. Hence you can increase the number of files open at one time by using the following strategy:

1. Allocate space for your own file handle table.
2. Fill your table with DOS's flag for unused handles (OFF Hex).
3. Copy DOS's file handle table into your own table.
4. Set the PSP's table size to the size of your table.
5. Set the PSP's table pointer to point to your table.

Figure 2 is a program demonstrating this technique.

Turbo Pascal has a seldom-used directive that specifies the number of files that may be open at one time. At the beginning of your program, use the F directive with the desired number of files.

Borland's Database Toolbox B+ tree routines use separate files for each indexed

field in a record. This means that the number of indexed fields per record is limited to the number of files you can open at one time. Using this little trick will let you use lots of indexes for complicated databases.

For the duration of your program, you

■ Any one process can really only open at most 20 files, and DOS takes over 5 of those. But you can increase the number of files open at one time.

can open as many files as you specified in your table up to a maximum of 255. This works with PC DOS 3.1 but does not seem to work with MS-DOS 2.11. This might be due to DOS storing the address of the file handle table at a different location in the PSP. This is just a guess, though.

Robert and Joy Horton
McAllen, Texas

I added an example program that creates the directory "TEMP" and writes 75 emp-

ty files in that directory. Do note that in order to successfully run this program, you must compile it to a .COM file first. And, of course, you must change the FILES= line in your CONFIG.SYS file and reboot.—Neil J. Rubenking

BRIGHTENING BACKGROUNDS

The procedure SetBlinkBit (Figure 3) allows you to display characters with a high-intensity background using a monochrome monitor and adapter. To do this you must turn off the blink bit (bit #5) in the Display Mode Control Port (3B8h) and set Turbo's text color to include blinking. Now every character written with a blinking attribute will display with a high-intensity background. In initiating the high-intensity background you must set Turbo's attribute byte directly, as Turbo's TextBackground procedure will not pass high-intensity values (values > 7). [In fact, you set the blink attribute via the TextColor procedure, for example, by including

```
TextColor(LightRed + blink);
as a statement.—NJR.]
```

These procedures worked fine on an IBM PC-XT with monochrome display and a Hercules mono adapter, however, I have not tested them on other monochrome machines.

Ted Bales
Greenville, North Carolina

```

[38]
PROGRAM Handles;
(* MUST be compiled to .COM file *)
(*P355) (Tell Turbo how many files you want to open)
CONST
  handles_desired = 75;
  (* number of file handles you want available at one time *)
  actual_files = 75;
  (* file less than the number of handles -- DOS uses file *)

VAR
  hndp1 : ARRAY[1..actual_files] OF Word;
  n : Integer;
  handle_table : ARRAY[1..handles_desired] OF Byte;
  (* the new file handle table which DOS will use, each handle is 1 byte *)

PROCEDURE FILE_HANDLE_RAP;
TYPE
  PFP_type = RECORD
    max_handles : (32n) (* max handles, set by *)
    (* FILESP=xx is config.sys *)
    table_off : (34n) (* offset of file handle table *)
    table_size : Integer; (34n) (* segment of file handle table *)
  END;

VAR
  PFP : PFP_type;
  hndp1 : (32n) (* in the code segment *)
  n : Byte;
  p : Byte;
  handle : Word;
  p1 : PFP_type;
  fillchar(handle_table, handles_desired, 0FFh);
  (* DOS uses PFP to indicate an unused handle. *)
```

```

WITH PFP DO
  BEGIN
    WriteLn(max_handles, ' handles were available');
    IF max_handles > 25 THEN
      Move(p1, handle_table, 25)
    ELSE Move(p1, handle_table, max_handles);
    max_handles := handles_desired;
    table_off := 0C(handle_table); (* set the pointer to point to *)
    table_size := seg(handle_table) * (your table)
    WriteLn(max_handles, ' handles now available');
  END;

END;
(* file_handle_rap *)

FUNCTION Handle_Of(VAR P : Integer;
  VAR I : Integer Absolute P;
  BEGIN
    handle_of := I;
  END;

BEGIN
  (I) := CHR('TEMP'); (* (I) *)
  (* Check for presence of "TEMP" directory by attempting to CHR to it *)
  IF IOResult < 0 THEN WriteLn('TEMP');
  (* If the attempt failed, then create the directory "TEMP" *)
  P := Handle_RAP;
  FOR I := 1 TO 75 DO
    BEGIN
      Assign(hndp1, 'temp\ANAPLE.' + Chr((I DIV 10)+48) + Chr((I MOD 10)+48));
      Rewrite(hndp1);
      WriteLn(I, ' files opened -- handle is ', handle_of(hndp1));
    END;
  END;
```

Figure 2: How to open more than 15 files in Turbo Pascal.

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■ LANGUAGES

```

($R*,C-)
PROGRAM Test_High_Intensity_Background;
TYPE
  Switch = (On, Off);
CONST
  Control = $3B8;
  { For color, $3D8 }
PROCEDURE SetLinkBit(Indicator : Switch);
BEGIN
  IF Indicator = On THEN
    Port[Control] := Port[Control] OR $20 {Blinker Bit On}
  ELSE
    Port[Control] := Port[Control] AND (NOT $20); {Blinker Bit Off}
END;

BEGIN
  ClrScr;
  TextBackground(LightGray);
  TextColor(Black+Blink);
  SetLinkBit(Off);
  WriteLn(' This is 80x80 Intensity Background. '); WriteLn;
  TextBackground(7); TextColor(Black);
  WriteLn(' This is LOW Intensity Background. '); WriteLn;
  WriteLn(' Press a key. '); WriteLn;
  REPEAT UNTIL KeyPressed;
  SetLinkBit(On);
  Write(' Blinker Bit is Now Reset. ');
END.

```

Figure 3: A procedure to enable high-intensity background characters.

*This procedure (included in the program **Test_High_Intensity_Background**, which switches between a high- and low-intensity background until you select either one) should work fine on any standard monochrome system. You can perform that same trick on a standard CGA—just change the constant **ControlPort** to **\$3D8**. However, it will not work on an EGA. If you want the bright-background effect on an EGA, you will have to manipulate the EGA palette.*—Neil J. Rubenking

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DEINSTALLING TSRs

Could you explain the technique used by a TSR to deinstall, reset the interrupt vectors, and free up its memory allocation? I've examined several sections of commercial code that do this but can't figure out how they work.

Paul G. Wing
Des Plaines, Illinois

Deinstalling a TSR is conceptually easy, though depending on the complexity of the program, it can quickly become a messy process to implement. For the sake of simplicity, I'll explain the process in terms of a single-segment .COM file that doesn't itself allocate any extra memory. Keep in mind, however, that every program is a little different from every other program, and .EXE programs are different still.

Let's start by examining exactly what happens when a program makes a Terminate and Stay Resident call. Each program loaded by DOS is allocated two blocks of memory. The first block contains a copy of the current environment, and the second block, which I'll call the PSP block, contains the program itself. These blocks are identified to DOS by their segment value—that is, the address of the paragraph at which the block begins relative to the start of memory.

After the program is loaded into memory, control is passed to its first executable instruction. For .COM files, this is located at offset 100h in the PSP block. We can safely assume that our TSR program will then proceed to check the hardware and initialize some values for later use. We'll

also assume that an interrupt vector is chained. Now, what does that mean?

TSRs usually hook into software or hardware interrupts. Interrupts are the PC's way of communicating and transferring control when a certain event occurs. One such interrupt is INT 9, the keyboard interrupt, which is generated each time a key is struck. This is the interrupt generally used to check for the hotkey combination the TSR uses to pop up.

Chaining into an interrupt is accomplished by changing the contents of the interrupt vector (located in low memory) so that it points to a routine inside the code portion of the TSR. The old interrupt vector address is saved so that control can be passed on to the previous routine. Thus, the new flow of control is a path that passes through the TSR.

When the TSR installation is completed, a DOS function call to "Terminate and Stay Resident" is executed, specifying the

amount of memory that the program wishes to keep. DOS then assumes responsibility for not loading other programs over the resident code.

To deinstall the TSR, you simply undo the steps you performed to install it. First you restore any interrupt vectors you may have changed to their previous values. Then you deallocate the memory occupied by the TSR. In an ideal world—in which only one TSR is loaded—this simple approach will work. But in today's real world, a TSR must be "well behaved" and take a few precautions before removing itself from memory.

The reason for the precautions is that a simple deinstallation may not be feasible. If another TSR has loaded after our program and has chained onto the same interrupts, the vector address in low memory now points to a spot in the second TSR. The new TSR has saved our location and is expecting our code to be there when it passes control on. If our TSR were simply to get uninstalled, DOS might then load still another program in its former location, and the computer will probably hang. And if the vector our TSR saved is restored, it will bypass the new TSR and render it useless.

To ensure that none of this happens, a well-behaved TSR must verify that each intercepted vector still points inside the TSR. When this is the case, no other TSRs have been installed after it, and the original vectors can safely be restored. The memory allocated to the TSR can then be released by placing the segment of the TSR PSP in the ES register and calling DOS INT 21h

■ **Deinstalling a TSR is conceptually easy, though depending on the complexity of the program, it can quickly become a messy process.**

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function 49h, "Free Allocated Memory."

For a more detailed tutorial that handles the problem of multiple TSR installations and includes some easy-to-follow examples, you should look at Jeff Prossie's outstanding pair of utilities, *INSTALL* and *REMOVE*, in *PC Lab Notes*, *PC Magazine*, Volume 6 Number 14.

PARKING HARD DISKS

I've frequently read that it's important to park the heads on a hard disk before turning it off. But all the hard disks I've seen have their own separate parking programs that warn about using them on other drives. Is there a safe way to park?

Michael Minnis
Oklahoma City, Oklahoma

Parking the heads is an important part of disk drive usage. Many of the high-performance disks being sold today do have dedicated hardware to park the heads when power is removed. But for the owners of older hard disks, a park program is a must.

A park program generally moves the disk heads to the last cylinder, or track, on the drive. Since data is written starting with track 0, the last track is the least likely to contain anything important.

Manufacturers are correct when they warn you not to use their park programs on other hard disks, however. Because the programs were meant to be sold with a sin-

gle drive, the last cylinder number is usually hard-coded into the program. Thus, using a park program designed for a drive with 100 cylinders on a disk that has 200 cylinders will place the heads in the middle of the disk and in a position to do some damage.

Figure 1 lists a small assembly code routine that will park up to two separate hard disks on your computer at their last cylinder. The program first uses a BIOS call to determine the number of cylinders on each disk. A second BIOS function is then invoked to position or "seek" the heads at that cylinder.

To create the file, make sure *DEBUG* is either in your current directory or in a directory accessed by your *PATH* command. Then simply start *DEBUG* and type in the instructions exactly as shown in Figure 1. Be sure to include the blank line—just an <Enter>—after the *RET*. This will create the file *PCPARK.COM*. From then on, before you turn your computer off (or anytime you want to park the heads), just run *PCPARK* at the DOS prompt.

CONVERTING TO .COM FILES

I have been doing a lot of BASIC programming lately, and have been compiling programs with some strange results. Why can't I convert an .EXE file to a .COM file with the *EXE2BIN* program?

John MacGregor
San Jose, Costa Rica

Both .COM and .EXE files are executable files that can be loaded and run under DOS. The .COM format is very simple and was built into DOS partly to ease conversion of programs from the older CP/M operating system. Files with an .EXE extension are more complex and therefore more versatile. The two file types are treated quite differently by DOS.

Assembly language is usually used to construct a .COM file, which is basically a memory image and contains no other information that DOS can use. To load it, DOS builds a Program Segment Prefix (PSP) and copies the .COM file directly into memory after it. Control is then passed to the first byte of the file, which is located at offset 100h in the segment. The file must be smaller than 64K, and it is restricted to using a single segment. Only

```
N PCPARK.COM
A 100
MOV DX, 0000
CALL 0109
MOV DX, 0001
MOV AH, 08
PUSH DX
INT 13
MOV AH, 0C
POP DX
INT 13
RET

RCX
14
W
Q
```

Figure 1: A head-parking program you can create with *DEBUG*.

programs specifically designed to become .COM files can be converted by EXE2BIN.

High-level languages, like BASIC, C, and FORTRAN, usually produce an .EXE file. These files can be larger than 64K, may contain multiple segments, and are prefixed by a 512-byte header. The header

sive operation such as copying a large number of small files. If you don't see any errors or hear any retries (a rattling sound as the head is moved to track 0 and reset), and your diskette reads and writes

without a problem, then your drive will probably function fine with the fast rate.

Although it is possible to burn out a diskette drive motor, it's very unlikely that changing the step rate time will do so. I set

■ Only programs designed to become .COM files can be converted by EXE2BIN.

contains information that the DOS loader must use to position the segments properly, to allocate memory, and to start program execution.

Detailed information on both the .COM and .EXE file formats can be found in the DOS Technical Reference manual.

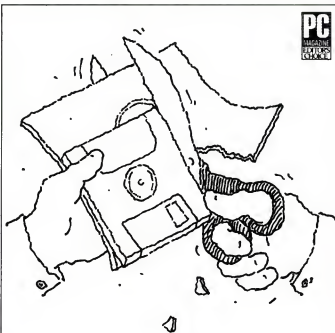
SPEEDING UP DISK DRIVES

I recently installed a public-domain diskette drive speed-up program. While I haven't timed the drive, it now makes a more abrupt sound when moving the head. Will this change in the way the head moves make a difference in the life of the drive or the accuracy of the data?

Tim S. Hallen
Auburn, Washington

The parameter being changed by the speed-up utility is the head step rate. Since this rate is faster, the time it takes the head to move from track to track is reduced. But the inertia built up by the head must be damped when it reaches the desired track. A faster-moving head is harder to stop, and so tends to "bounce" a little. This directly affects another diskette drive parameter, the head settling time.

A head that is bouncing may tend to misread information on the disk. This will usually generate a "bad sector" error message. When this type of error occurs, DOS will retry the operation from three to five times, depending on the version. To determine if errors will be a problem for your specific drive, perform a disk-inten-



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Christopher O'Malley
PERSONAL COMPUTING, April '86



"Because copy protection can interfere with the ability to back up a hard disk, business-oriented users may prefer programs like TranSec's UNlock series."

Winn L. Rosch
PC MAGAZINE, May 27, 1986

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Jerry Poumelle, BYTE, Feb. '86
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■ PC TUTOR

my first computer, a dual-floppy XT compatible, to operate with a head step rate of 0, and I experienced no problems.

MAGNETIC ENCOUNTERS

I have read that placing a diskette close to an electric field will erase files. I have purposely placed diskettes close to telephones, tape recorder heads, TVs, fans, and fluorescent lamps, and no files were damaged. Does this mean that electric fields pose no problem?

Mike Greene
Los Angeles, California

Also intrigued by this question, I ran my own test a few years ago. I found out that most electric and magnetic fields encountered in a normal environment pose little hazard to the data on a floppy disk. (Except, that is, for the unique floppy disks used by a manufacturer who always blames the failure of his demo programs on airport X-ray machines. Sure.)

The most potent disk killers I have

■ The most potent disk killers include magnetized screwdrivers and paper clip holders.

found in the office environment include magnetic paper clip holders and magnetized screwdrivers rolling around on desktops. And at home, I have framed the Smurf magnet my wife once used to tack a floppy of important files to the refrigerator so I wouldn't forget it.

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally.

■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



Keeping cabdriver radio broadcasts off the phone lines; a video adapter checking program that works at log-in; 1-2-3 file transfers from IBM System/3x to the PC.

1-2-3 VIDEO DRIVERS ON A LAN

One of the biggest problems I have managing our Novell network is giving users the correct video drivers for programs like Lotus's 1-2-3. The users on my network might log in to the network on a PC with a color card one time and then log in on a machine equipped with a Hercules monochrome graphics card the next time. This makes it impossible to map the drives containing the video drivers according to the user's ID.

The next logical alternative is to map the drive containing the video drivers based on the video adapter inside the PC itself. I wrote the following BASIC program (Figure 1) that checks for the presence of a Compaq PC color/monographics adapter, an enhanced graphics adapter, a color graphics adapter, a Hercules monographics adapter, or an IBM monochrome adapter and alerts the network to provide the correct 1-2-3 drivers.

The user's log-in script creates two virtual drives containing 1-2-3 program files. The first drive contains the actual 1-2-3 program without any drivers, and the second contains a dummy driver directory. The drivers for the particular video adapter are mapped to this dummy directory by the BASIC program. Since both are search drives (Novell's equivalent of a PATH statement in DOS), the program will load from the first search drive and find the drivers that match the video adapter in that PC on the other search drive. In my case, the path of the Lotus directory is

and the path of the dummy directory is

```
SYS:PROGRAM\LOTUS\DRV
```

This dummy directory is remapped by the program to

```
SYS:PROGRAM\LOTUS\XXX
```

with XXX being one of the following variables:

MNO = Monochrome drivers
CPQ = Compaq drivers
CLR = Color drivers
EGA = Enhanced graphics drivers
HRC = Hercules drivers

Line 150 goes out to the Novell work-

station shell and remaps the search drive based on which of the above three-character video adapter abbreviations is loaded in MON\$. The Y.DAT file is needed because NetWare asks if you really wish to remap the search drive and the response is Y. All you need in the Y.DAT file is a Y and a carriage return. The >> NUL: in line 150 keeps this exchange off the user's screen.

Lines 20 to 30 pass variables to the subroutine in line 170 to check memory location FFFE:000A for the string COMPAQ. If it finds it, the program sets MON\$ to CPQ and then goes to line 150.

Lines 40 to 50 pass variables to the sub-

```
10 CLS:LOCATE 1,1,0
20 DTSG=&HFFFF:DTA$="COMPAQ":DLC=&HA:GOSUB 170
30 IF DTA$=DTARD$ THEN 110
40 DTSG=&HC000:DTA$="IBM":DLC=&H1E:GOSUB 170
50 IF DTA$=DTARD$ THEN GOTO 130
60 BFST=(INP(&H3BA)AND &H80)
70 FOR I=1 TO 75:BSND=(INP(&H3BA)AND &H80)
80 IF BSND<>BFST THEN GOTO 140 ELSE NEXT I
90 DEF SEG=0:IF (PEEK(&H410)AND &H30)<>&H30 THEN GOTO 120
100 MON$="MNO":GOTO 150
110 MON$="CPQ":GOTO 150
120 MON$="CLR":GOTO 150
130 MON$="EGA":GOTO 150
140 MON$="HRC"
150 SHELL "MAP V:=SYS:PROGRAM\LOTUS\"+MON$+" < Y.DAT >> NUL:"
160 END
170 DTARD$="":DEF SEG=DTSG:FOR I=1 TO LEN(DTA$)
180 RD=PEEK((DLC-1)+I):DTARD$=DTARD$+CHR$(RD)
190 NEXT I:DEF SEG:RETURN
```

Figure 1: A BASIC program that checks for the presence of a Compaq PC color/monographics adapter, an enhanced graphics adapter, a color graphics adapter, a Hercules monographics adapter, or an IBM monochrome adapter and alerts the network to provide the correct 1-2-3 drivers.

```
SYS:PROGRAM\LOTUS
```

■ CONNECTIVITY CLINIC

routine to check memory location C000:001E for the string IBM. If it finds it, the program sets MON\$ to EGA and then goes to line 150.

Lines 60 to 80 read a byte from port

3BA (Hercules video retrace) and isolate bit 7. Then they do a FOR/NEXT loop while comparing the first byte read with subsequent bytes. If they are different, the program exits the loop and sets MON\$ to

HRC. You might need to increase the length of the FOR/NEXT loop, depending on the speed of your PC. A value of 100 works with 6-MHz ATs. Values lower than 75 cause the program to select a monochrome adapter automatically.

Line 90 checks for a color adapter. This is taken out of the IBM BASIC 3.0 manual with minor changes made to check for the color adapter. If the statement is true, the program sets MON\$ to CLR and goes to line 150. If all else fails and the program gets to Line 100, then the program declares that a mono adapter is in use, sets MON\$ to MNO, and goes to line 150.

Lines 170 to 190 take the variables from lines 20 and 40; read from memory the address DTSG (data segment), the DLC (data location), and a number of bytes determined by DTAS (data to be read) and DTARDS (data read from memory), and then return.

I hope that others who have PCs with different video adapters scattered about their network find this program useful. Line 150 can be modified to send multiple commands to DOS or to send commands for other networking programs.

Alex Perez
Miami, Florida

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LINKING PCs AND MINIS

Several of our PCs are connected to an IBM System/36, and we use the PCs as terminals. We often have to rekey information from System/36 printouts into a 1-2-3 spreadsheet. Is there an easy way to transfer data from a System/36 to 1-2-3 on a PC? Our programmer says System/36 files are packed in such a way that the effort in editing them would be more than the effort involved in rekeying them into a spreadsheet. Is this true?

Vivek Channmugan
Austin, Texas

There is little effort involved if you have the right file transfer software. The IBM System/3x minicomputers use a fixed-length record and the EBCDIC data alphabet. The PC uses several variable-length record formats and the ASCII data alphabet.

According to Glenda Thomas of Emerald Technology, PC to System/3x links, such as those Emerald sells, typically come with file transfer programs able to

convert System/3x files into ASCII or .DIF files. These formats can be imported into 1-2-3. You might have to clean the files up a little with a text editor, but it isn't a big job.

Digital Communications Associates has a file transfer program in its Smart Alec System/3x connection system that translates directly into .WKS and .WRK formats. The phone number for Emerald Technology is (206) 462-8200. DCA is at (404) 442-4000.

TAXIS OFF-LINE

Our warehouse is next to a taxi dispatch office, and its radio signals get into our telephone lines. We don't make many calls from there, so we just ignored it. But when we installed a terminal and a modem and tried to do remote data entry, the radio interference became a problem. One of the radio technicians from the taxi company wrapped the telephone line through something called a ferrite toroid coil, which he got from MFJ Enterprises.

Now the radio signals can't be heard on the line, and the modem works fine. Other readers with this problem might be able to do the same thing.

Jonathan Paine
Louisville, Kentucky

Toroid coils block RF on wires and cables and don't require cutting the insulation or soldering. MFJ Enterprises sells a package of four toroids for power or phone lines for \$14.95. If they solve your problem and clear up the noise on the lines, they can be a real bargain. Phone MFJ at (601) 323-5869.

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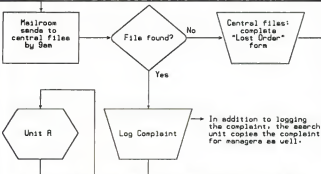
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* March 10, 1987 issue page 279

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*Starch Study, July 1986



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 - 12V 250mA, 5 200mA



PS-1550

MONITORS**SAMSUNG MONOCHROME**

- IBM COMPATIBLE TTL INPUT
- 12" NON-GLARE, LOW DISTORTION, AMBER SCREEN
- RES. 720 x 350
- SWIVEL BASE
- 1 YEAR WARRANTY

**\$129.95 MULTISYNC BY NEC \$549.95**

- ORIGINAL CGA, EGA, VGA COMPATIBLE MONITOR
- AUTO FOCUS/HUE ADJUSTMENT
- AUTO RETUNE FOR HIGH AS 500 x 500

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- RES. 640 x 350-360
- 31mm DOT PITCH
- 12" BLACK MATRIX SCREEN
- 15 COLORS FROM 64

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- COLOR: GREEN, AMBER SWITCH
- RGB: IBM COMPATIBLE
- 30mm DOT PITCH
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- CABLE FOR IBM PC INCLUDED

MONOCHROME BY HYUNDAI \$69.95

- IBM COMPATIBLE TTL INPUT
- 12" NON-GLARE AMBER SCREEN
- ATTRACTIVE CABING WITH A TILT SWIVEL BASE

TOLL FREE**800-538-5000 U.S. AND CANADA****20MB HARD DISK ON A CARD**

- SAVES SPACE AND REDUCES POWER CONSUMPTION
- IDEAL FOR PCs WITH FULL HEIGHT FLOPPY S
- LEAVES ROOM FOR A HALF LENGTH CARD IN ADJACENT SLOT

\$349**RITEMAN II PRINTER**

- 160 CPS DRAFT, 32 CPS NLO MODE
- SUPPORTS EFDON: IBM GRAPHICS
- 5 x 9 DOT MATRIX
- FRICTION AND INK FEEDS
- VARIABLE LINE SPACING & PITCH

\$21995**IBM COMPATIBLE PRINTER CABLE \$8.95 REPLACEMENT RIBBON CARTRIDGE \$7.95****DISK DRIVES****5 1/4" SEAGATE HARD DISK DRIVES**

- | | | | |
|---------|------------------|-----------|-------|
| ST-225 | HALF HEIGHT 20MB | 65ms | \$250 |
| ST-236 | HALF HEIGHT 30MB | 65ms (RL) | \$299 |
| ST-251 | HALF HEIGHT 40MB | 65ms | \$469 |
| ST-277 | HALF HEIGHT 60MB | 40ms (RL) | \$649 |
| ST-4038 | FULL HEIGHT 30MB | 40ms | \$559 |
| ST-4096 | FULL HEIGHT 80MB | 28ms | \$895 |

1/2 HEIGHT FLOPPY DISK DRIVES

- | | | |
|--------------------------|---------------|----------|
| 5 1/4" TEAC FD-58B DS | DD 360K | \$99.95 |
| 5 1/4" TEAC FD-55F DS | QUAD 720K | \$119.95 |
| 5 1/4" TEAC FD-55G DS | HD 1.2M | \$129.95 |
| 5 1/4" FUJITSU M2581A DS | DD 360K | \$89.95 |
| 5 1/4" FUJITSU M2553K DS | HD 1.2M | \$119.95 |
| 5 1/4" DS | DD 360K | \$69.95 |
| 5 1/4" DS | HD 1.2M | \$109.95 |
| 3 1/2" MITSUBISHI DS | DD (AT DR KT) | \$129.95 |

DISK DRIVE ACCESSORIES

- | | |
|----------------------------------|--------|
| 1/2 HT MOUNTING HARDWARE FOR IBM | \$2.95 |
| MOUNTING RAILS FOR IBM AT | \$4.95 |
| "Y" POWER CABLE FOR 5 1/4" FDDs | \$2.95 |
| 5 1/4" FDD POWER CONNECTORS | \$1.15 |

DRIVE ENCLOSURES WITH POWER SUPPLIES

- | | | |
|----------|--------------------------|----------|
| CAB-25VS | DUAL SLIMLINE FOR 5 1/4" | \$49.95 |
| CAB-1PHS | FULL HEIGHT FOR 5 1/4" | \$69.95 |
| CAB-25VS | DUAL SLIMLINE FOR 8" | \$209.95 |
| CAB-2FH8 | DUAL FULL HEIGHT FOR 8" | \$219.95 |

EASYDATA MODEMS

All models feature auto-dial, answer/redial on busy power up self test, touchtone or pulse dialing, built-in speaker, Hayes and Bell Systems 103 & 212A compatible, full or half duplex, PC-Talk III Communications software with internal models and more.

**INTERNAL**

- | | | |
|-----|---------------------|----------|
| 12H | 1200 BAUD 1/2 CARD | \$69.95 |
| 24B | 2400 BAUD FULL CARD | \$179.95 |

EXTERNAL

(NO SOFTWARE INCLUDED)

- | | | |
|-----|-----------|----------|
| 12D | 1200 BAUD | \$119.95 |
| 24D | 2400 BAUD | \$219.95 |

COMPUTER CASES

Attractive, sturdy steel cases fit the popular sized motherboards and include speakers, faceplates, expansion slots and all necessary hardware.



- | | |
|----------------------------------------|----------|
| KT STYLE FLIP-TOP | \$34.95 |
| KT STYLE SLIDE-TOP | \$39.95 |
| AT STYLE SLIDE-TOP | \$89.95 |
| FRONT PANEL KEYLOCK AND LED INDICATORS | |
| JR. AT STYLE FLIP-TOP | \$149.95 |
| INCLUDES 180 WATT POWER SUPPLY | |
| FRONT PANEL KEYLOCK AND LED INDICATORS | |



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FAX (408) 378-8927 • Telex 171-110
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TERMS: Minimum order \$10.00. For shipping and handling include \$2.50 for UPS Ground and \$3.50 for UPS Air. Orders over \$100 and foreign orders may require additional shipping charges—please contact our sales department for the exact. CA residents must include applicable sales tax. All merchandise is warranted for 90 days unless otherwise stated. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities and to substitute manufacturers. All merchandise subject to prior sale. A full copy of our terms is available upon request. Items pictured may only be representative.

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ALL MCT PRODUCTS CARRY A 1 YEAR WARRANTY

INTERFACE CARDS

FROM MODULAR CIRCUIT TECHNOLOGY



MCT-MGP



DISPLAY CARDS

MCT-MGP MONOCHROME GRAPHICS \$59⁹⁵

- TRUE HERCULES COMPATIBLE (V) SUPPORTS LOGIS 122
- SOFTWARE DRIVER ALLOWS COLOR GRAPHICS PROGRAMS TO RUN ON A MONOCHROME MONITOR
- PARALLEL PRINTER PORT

MCT-EGA ENHANCED GRAPHICS ADAPTOR \$149⁹⁵

- 100% IBM COMPATIBLE, PASSES IBM EGA DIAGNOSTICS
- 256K OF VIDEO RAM ALLOWS 640 x 350 IN 16 OF 84 COLORS
- COMPATIBLE WITH COLOR AND MONOCHROME ADAPTOR

MCT-CG COLOR GRAPHICS ADAPTOR \$49⁹⁵

- COMPATIBLE WITH IBM COLOR GRAPHICS STANDARDS
- SHORT SLOT SUPPORTS RGB, COLOR & COMPOSITE MONOCHROME
- 640 x 320 x 200 RESOLUTION, LIGHT PEN INTERFACE

MULTIFUNCTION CARDS

MCT-MF MULTIFUNCTION \$79⁹⁵

- ALL THE FEATURES OF 4 PACK AT HALF THE PRICE
- 0-394K DYNAMIC RAM USING 4194a
- SERIAL, PARALLEL, GAME PORTS, CLOCK CALENDAR

MCT-MMIO MONOGRAPHS I/O \$119⁹⁵

- TOTAL SYSTEM CONTROL FROM A SINGLE SLOT
- 2 FLOPPY CONTROL, SERIAL, PARALLEL, GAME PORT, CLOCK CAL
- RUN COLOR GRAPHICS SOFTWARE ON A MONOCHROME MONITOR

MCT-MIO MULTI I/O FLOPPY \$79⁹⁵

- A PERFECT COMPANION FOR OUR MOTHERBOARDS
- SERIAL, PARALLEL, GAME PORT, CLOCK CALENDAR
- SUPPORTS UP TO 2 360K FLOPPY, 720K WITH DOS 3.2

MCT-IO MULTI I/O CARD \$59⁹⁵

- USE WITH MCT-IF FOR A MINIMUM OF SLOTS USED
- SERIAL PORT, CLOCK CALENDAR WITH A BATTERY BACK UP
- PARALLEL PRINTER PORT ADDRESSABLE AS LPT1 OR LPT2

MCT-ATMF AT MULTIFUNCTION \$139⁹⁵

- ADDS UP TO 3 MEGABYTES OF RAM TO THE AT
- USER EXPANDABLE TO 15 MB OF MEMORY (ZERO K INSTALLED)
- INCLUDES SERIAL PORT AND PARALLEL PORT

MCT-ATMF-MC PIGGYBACK BOARD (NO MEMORY) \$29⁹⁵

- ATMF-SERIAL 2ND SERIAL PORT
- MCT-ATMF-MC PIGGYBACK BOARD (NO MEMORY)

MCT-ATIO AT MULTI I/O \$59⁹⁵

- USE WITH MCT-ATMF FOR A MINIMUM OF SLOTS USED
- SERIAL, PARALLEL AND GAME PORTS
- USE 16800 SERIAL SUPPORT CHIPS FOR HIGH SPEED OPERATION

MCT-ATMF-MC PIGGYBACK BOARD (NO MEMORY) \$29⁹⁵

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MCT-RAM 576K RAM CARD \$59⁹⁵

- A CONTINUOUS MEMORY SOLUTION IN A SHORT SLOT
- USE SELECTABLE CONFIGURATION AMOUNTS UP TO 576K USING 64K & 256K RAM CHIPS (ZERO K INSTALLED)

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- 2 MB OF LOTUS INTEL AND DOS COMPATIBLE MEMORY FOR XT
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MCT-ATEMS AT VERSION \$139⁹⁵

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MCT-FDC FLOPPY DISK CONTROLLER \$29⁹⁵

- QUALITY DESIGN OFFERS A FLOPPY CONTROL IN A SINGLE SLOT
- INTERFACES UP TO 4 FLOPPY TO AN IBM PC OR COMPATIBLE
- SUPPORTS BOTH OS 00 AND OS 00 WITH DOS 3.2

MCT-HDC HARD DISK CONTROLLER \$79⁹⁵

- NO CONTROL FOR WHAT OTHERS CHARGE FOR FLOPPY CONTROL
- SUPPORTS 18 DRIVE SIZES INCLUDING 8, 10, 20, 30 & 40 MB
- DIVIDE 1 LARGE DRIVE INTO 2 SMALLER LOGICAL DRIVES

MCT-FDC-1.2 1.2MB FLOPPY CONTROLLER \$69⁹⁵

- ADD VERSA PLUS A CAPACITY TO YOUR XT
- SUPPORTS 2 DRIVES, BOTH MAY BE 360K OR 1.2 MB
- ALLOWS DATA TO FLOW FREELY FROM XTs TO ATs

MCT-FH FLOPPY/HARD CONTROLLER \$139⁹⁵

- SYSTEM STARTED FOR SLOTS 5A AND 5B WITH THIS TIMELY DESIGN
- INTERFACES UP TO 2 FLOPPY & 2 HDD, CABLEING FOR 2 FLOPPY & 1 HDD
- SUPPORTS BOTH OS 00 & OS 00 WITH DOS 3.2

MCT-ATFH AT FLOPPY/HARD CONTROLLER \$149⁹⁵

- FLOPPY/HARD DISK CONTROL IN A TRUE AT DESIGN
- SUPPORTS UP TO 2 360K 720K 1.2MB FLOPPY
- AS WELL AS 2 HDD, USING STANDARD CONTROL TABLES

Seagate

1/2 HEIGHT HARD DISK DRIVES

40 MB \$469
60 MB \$649

Drives are Seagate models ST-251 (40 MB) & ST-277 (60 MB) RLL 5 1/4" head heights
FAST 40ms access time!

1/2 HT HARD DISK SYSTEMS

20 MB \$289
30 MB \$329

Systems include Seagate 1/2 height hard drive, drive controller, cables & instructions. All drives are pre-tested & warranted for 1 year.

IBM COMPATIBLE MOTHERBOARDS

FROM MODULAR CIRCUIT TECHNOLOGY

MCT-TURBO TURBO 4.77/8 MHz \$99⁹⁵

- 4.77 OR 8 MHz OPERATION WITH 500K-2 & OPTIONAL 500K-2 CO-PROCESSOR
- FRONT PANEL LED SPEED INDICATOR AND RESET SWITCH SUPPORT
- CHOICE OF NORMAL TURBO MODE OR SOFTWARE SELECT PROCESSOR SPEED

MCT-XTMD STANDARD MOTHERBOARD \$97⁹⁵

- 8 SLOT (2 EIGHT BIT, 6 SIXTEEN BIT) AT MOTHERBOARD
- HARDWARE SELECTION OF 5 OR 8 MHz
- 1 WAIT STATE

MCT-ATMB 80286 5/8 MHz \$379⁹⁵

- KEYLOCK SUPPORTED, RESET SWITCH, FRONT PANEL LED INDICATOR
- SOCKETS FOR 1 MB OF RAM AND 80287
- BATTERY BACKED CLOCK

MCT-BATMB MINI 80286 \$369⁹⁵

- REPLACEMENT BOARD FOR XT STYLE CHASSIS
- OPERATE AT 5, 10 MHz WITH UP TO 1 MB ON BOARD MEMORY (ZERO K INSTALLED)
- SOCKET FOR 80287 WITH CO-PROCESSOR
- BATTERY BACKED CLOCK
- 8 SLOTS, 2 EIGHT BIT, 6 SIXTEEN BIT
- USE CHIPS & TECHNOLOGY CHIP SET FOR RELIABILITY AND SMALL SIZE

WHY BUY A SYSTEM FROM JOR?

- BUILD IT YOURSELF AND SAVE!
- MONEY BACK GUARANTEE (ASK FOR DETAILS)
- LEARN ABOUT THE INNER WORKINGS OF A COMPUTER
- YOU CAN ASSEMBLE A SYSTEM IN ABOUT 2 HOURS WITH A SCREWDRIVER & OUR EASY-TO-FOLLOW INSTRUCTIONS
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BUILD YOUR OWN 256K XT COMPATIBLE

- MOTHERBOARD
- 256K OF MEMORY
- 135 WATT POWER SUPPLY
- FLIP-TOP CASE
- XT STYLE KEYBOARD
- 360K FLOPPY DRIVE
- DRIVE CONTROLLER
- MONOCHROME MONITOR
- GRAPHICS ADAPTOR

FOR ONLY \$489¹⁵

ANYONE CAN BUILD A SYSTEM IN ABOUT 2 HOURS USING A SCREWDRIVER AND OUR EASY-TO-FOLLOW INSTRUCTIONS!



OVER 10,000 SOLD!

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FROM MODULAR CIRCUIT TECHNOLOGY

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- PROGRAMS 27xx & 27xx EPROMS UP TO 2732
- SUPPORTS VARIOUS PROGRAMMING FORMATS AND VOLTAGES
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- READ, WRITE, COPY, ERASE CHECK AND VERIFY
- BURNING FOR HEX ADDRESSABLE HEX FORMATS

MCT-EPM-4 4 DATA PROGRAMMER \$189⁹⁵

MCT-EPM-10 10 DATA PROGRAMMER \$299⁹⁵

MCT-PAL PAL PROGRAMMER \$289⁹⁵

MCT-MP PROCESSOR PROG. \$199⁹⁵



PARTIAL LISTING ONLY-CALL FOR A FREE CATALOG!

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The Northgate 286 System that was awarded

**Computer Shopper Magazine's
1987 BEST BUY...JUST BECAME
AN EVEN BETTER BUY!**



NEW 12MHz Clock Speed
60MB MiniScribe
FAST HARD DISK DRIVE

1 Full Megabyte
High Speed 120NS
Memory on The
Motherboard
2 Floppy Drives
and MS-DOS
GW BASIC

Includes
Northgate's Exclusive 101-key "C/T"
Click-Tactile Enhanced Keyboard!

Sold Direct-to-You at History-Making Low Cost with No Middle-Man Markups!

**FULL
SYSTEM
PRICE**



\$ 1999⁰⁰ complete

NOW...Northgate Brings You the Industry's Highest Performance Systems at Industry-Low Prices!

"E/T"™ Enhanced Technology Complete Systems

RLI HARD DRIVE ENCODING, 1:1 INTERLEAVING AND 2.5 TIMES FASTER DATA TRANSFER CONTROLLER = LIGHTNING FAST COMPUTING PERFORMANCE AT A PRICE OTHER COMPUTER VENDORS CAN'T MATCH!

If you're a first-time computer shopper, looking at all the ads, you're probably plenty confused. BUT, YOU KNOW YOU JUST CAN'T BUY A FULL AT SYSTEM FOR \$995.00 OR AN XT FOR \$349.00 AS OTHERS ADVERTISE. THAT'S LIKE A CAR WITHOUT WHEELS.

Don't be misled by the confusing "bare bones" or "basic system" pricing others use just to appear competitive. By the time you add up everything else you need, you'll end up paying more and probably getting just an **ordinary performance machine**. Knowledgeable computer buyers know that Northgate offers **Complete Systems** that are truly different from the rest of the pack. That's why Computer Shopper named Northgate's 286 as the 1987 BEST BUY IN COMPUTING. Now, Northgate's innovative design skills have created "E/T"™ Enhanced Technology Systems with even better performance and value.

Our proven method of RLL encoding superb MiniScribe hard drives gives you 50% more hard drive storage for your money. A 1:1 interleave is applied to the drives. This delivers data from the disk to the read-write heads 200% to 600% faster than the drive/controller combination most other competitors provide.

Northgate uses an OEM hard drive controller with data transfer rates up to four times faster than most competition.

The result is a true Power System with overall system performance at least 2.5 times that of systems using ordinary, off-the-shelf parts.

Northgate has developed a thoroughly reliable method of using RLL encoding on the hard drives in all our 286 "E/T" systems. In 80286 systems, this technology is unknown to most of our competitors. Call them! You'll be amazed to find almost none offer RLL drives in 286 systems. Some will even tell you it can't be done. Next, ask about vital throughput factors like controller data transfer rates and interleaving ratios.

Most competitors merely assemble a collection of parts so archaic as to actually degrade performance. The Drive/Controller combinations most others use have the effect of **harnessing a race horse to a plow**. Processor speed is wasted because controller transfer time is so agonizingly slow.



Northgate takes the confusion, uncertainty and guesswork out of buying your computer. Skillfully assembled, thoroughly tested, your Northgate system arrives fully configured, ready to plug together and use. And Northgate has designed the most thorough, easy-to-follow documentation that takes novice or professional from set-up to shut down.

WRITTEN IN ENGLISH!

We format and partition your hard drive to your specifications using advanced OnTrack Software which we even send with your system at no extra charge.

All these are the compelling reasons why Northgate Systems are used by: **Government Agencies**—FAA, EPA, DNR, USDOC, INTERIOR, USDA, NPS; **Fortune 500 Corporations**—RCA, Westinghouse, Intel, General Dynamics, Bell Southern, Dow Chemical, Honeywell and many more; **Colleges and Universities**—So. Cal., Duke, Iowa State, N. Car., S. Car., Mo., Harvard and more, as well as **thousands of small businesses and individuals worldwide**.

Add to all these features, the most meaningful Consumer Protection Policies in the computer industry (see next page).

So forget competition's bare bones prices and those just ordinary systems... **COMPARISON WILL PROVE NORTHGATE OFFERS MORE!**

STANDARD NORTHGATE SUPER/TURBO 286-60 "E/T" SPECIFICATIONS:

PROCESSOR	INTEL 80286
PROCESSOR SPEED	8/12 MHz, 1 WAIT
MAKE OF BIOS	AWARD WSETUP
EXPANSION SLOTS	IN ROM
STANDARD MOTHERBOARD MEMORY	8 (TWO 8 BIT, SIX 16 BIT)
CO-PROCESSOR SLOT	1 MEGABYTE
CLOCK-CALENDAR	120NS
NO. OF FLOPPY DRIVES	YES
(NOTE: 3 EXPOSED HALF HEIGHT DEVICES MAY BE INSTALLED)	YES WITH AA
BRAND OF FLOPPY	2—1.2MB AND 360K
NO. OF HARD DRIVES	FUJITSU
TYPE OF HARD DRIVE	1 (SPACE FOR TWO)
HARD DRIVE FORMATTED	MINISCRIBE
STD. MONITOR TYPE	MODEL 3650
STD. VIDEO CONTROLLER	64.2 MEGABYTES
ADDITIONAL PORTS STANDARD	USABLE
KEYBOARD TYPE	SAMSUNG 12"
MS-DOS 3.2 & GWBASIC	AMBER TTL
CASE—FULL SIZE (NOT BABY AT)	HERCULES
	COMPT. 1 P.P.
	1 P.P., 1 S.P., 1 G.P.
	ENHANCED 101
	CLICK TYPE
	WITH HARD COVER
	MANUALS
	HAS CONTROL
	PANEL, LED'S AND
	SECURITY KEYLOCK

SUPER/TURBO 286-60 "E/T" SYSTEM PRICE COMPLETE \$1999.00

WITH ALL FEATURES ABOVE AND MINISCRIBE 32 MEGABYTE RLL HARD DRIVE SUPER/TURBO 286-30 "E/T" \$1899.00

OPTIONS—ADD:	
MINISCRIBE HARD DRIVES UP TO 380 MEGABYTES	CALL
SECOND SERIAL PORT	\$ 35.00
3.5 INCH FLOPPY SWAP FOR 1.2 OR 360	\$ 98.00
MATH CO-PROCESSOR CHIPS	CALL
COLOR GRAPHICS (CGA) MONITOR W/CD	\$295.00
COLOR GRAPHICS (EGA) MONITOR W/CD	\$495.00
MULTISYNC 14" MONITOR W/CD	\$695.00
(VIDEO CARD IS AUTOSENSE TYPE)	
A \$240.00 RETAIL VALUE ALONE	
HAYES COMPT. 1200 MODEM	CALL
HAYES COMPT. 2400 MODEM	CALL

Use Our Toll-Free Order Number
800-548-1993

AND FOR THE BEST BUY IN XTURBO "E/T" SYSTEMS...TURN THE PAGE

Northgate's V20/8MHz XTurbo Is Now Available with 65MB Hard Drive and the same "Enhanced Technology"



NOW...for the buyer who doesn't need 286 speed but wants an XT type system with through-put up to four times faster than other systems, Northgate offers its XTurbo/V20/8-65.

This system also features the MiniScribe hard drive and SMS high speed controller. It is furnished complete with:

V20 Microprocessor • 640K Memory on Motherboard • 360K Floppy Drive • MiniScribe 60MB FAST Hard Drive with 1:1 Interleave • 8 Expansion Slots • 2 Parallel, 1 Serial Port, Clock-Calender, Game Port • Amber Screen TTL Graphic Monitor with Hercules Compatible Video Card • Northgate "CT" Click-Tactile 84-key AT style keyboard • Case is the AT style with turbo button, keylock reset button and indicator lights. (Second Floppy Drive pictured is optional at additional cost.)

Complete System Price: \$1299⁰⁰

Same system with 30MB Hard Drive \$1149⁰⁰

NORTHGATE GIVES YOU THE MOST POWERFUL CONSUMER PROTECTION WARRANTY IN THE COMPUTER INDUSTRY...

30-Day Compatibility Warranty:

Northgate guarantees its systems will operate any standard, commercially available DOS programs written for use on IBM Compatible Computers. If, on consultation with Northgate, a program cannot be made to operate satisfactorily, owner may return the system, complete and unaltered for a prompt and full refund including all freight costs.

One-Year Overnight AT NORTHGATE EXPENSE Parts Replacement Warranty:

Northgate Computer Systems warrants that all systems sold by Northgate will be free of defects in workmanship and materials for one year from date of shipment.

In the event of failure of a part that disables the system Northgate will ship, the same day if notified by 12 Noon Central Time, a new replacement part. Customer must phone Northgate Customer Service for diagnosis of the failure.

Shipment of the replacement part will be by overnight express service—AT NORTHGATE'S EXPENSE—for next day delivery depending on the carrier's ability to provide such service in owner's geographic area.

Owner must return any replaced part, complete and unaltered, and pay return shipping costs, to be received at Northgate within two weeks after receiving the replacement part.

Northgate's Customer Service department will provide full instructions on making the repair or replacement and will consult with customer on the phone to assure repair is properly completed and the system is again operating.

In the case of a complete system returned for repair under warranty, customer pays freight to Northgate and Northgate pays return freight by whatever service the system is sent to Northgate.

In the event of a part replaced under warranty, the new part carries a NEW ONE-YEAR GUARANTEE FROM SHIP DATE!

NOTE: Many computer vendors extend only the parts manufacturer's warranty which may be as little as 30-days. All products sold by Northgate are fully guaranteed by Northgate for one year from date of shipment.

TERMS: Northgate accepts VISA and MASTERCARD charge cards with no surcharge. Purchase orders from established accounts, also accepted as well as COD (Cashiers Check) and Wire Transfer. Personal and Company Checks require 15 days to clear. APO and foreign orders accepted. All shipments are FOB Plymouth, MN. Delivery is subject to time required for order processing, manufacturing and 24 hour testing.

CONSUMER PROTECTION TIP TO PROSPECTIVE COMPUTER BUYERS:

When shopping, remember the Better Business Bureau Motto: "If it sounds too good to be true, it probably is!" Exceedingly low prices are your first warning.

Most computer direct sales firms are trustworthy. BUT, better to be safe than sorry.

BEFORE YOU PLACE YOUR ORDER, PHONE THE BETTER BUSINESS BUREAU OFFICE IN THE VENDOR'S AREA. (Your local BBB will give you the phone number for the appropriate office.)

Use our Toll-Free Order Number 800-548-1993

Hours: M-F
8 a.m. - 7 p.m.
Central.
Sat. 9-2



**NORTHGATE
COMPUTER
SYSTEMS**

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2905 Northwest Blvd., Suite 250 • Plymouth, MN 55441

Reports "Northgate's excellent tactile response approximates the "clicky" feel that IBM keyboards are known for. Typing on the C/T is smoother and more comfortable than on any of the replacement or clone keyboards I've tried." *Jonathan Matzkin*

**10-DAY TRIAL
MONEY BACK
GUARANTEE**

TOUCH TYPING IS BACK!

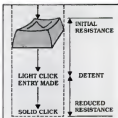


\$9900



\$7900

ENHANCED 101-KEY MODEL C/T 101:
Separate cursor pad and numeric keypad; Enlarged L-shaped Enter Key; Double-Wide Backspace, Shift, and CapsLock Keys; Lights for CapsLock, NumLock, ScrollLock. Fully A-T and XT Compatible. Heavy, metal base, keyboard won't slip around on desk.



THE TOUCH, THE SOUND, THE FEEL OF A SELECTRIC TYPEWRITER. YOU CAN GET IT NOW! INTRODUCING THE NORTHGATE "C/T" (Click-Tactile)

You're reading this ad because your current keyboard leaves a lot to be desired. IBM set the standard with the original PC Keyboard. And nothing else came close — UNTIL NOW!

LOW QUALITY CLONE KEYBOARDS EQUAL LOW COST CLONES...

Why are most clone keyboards so lacking? Because clone makers buy low cost keyboards to keep system costs down. The majority come from three manufacturers — KeyTronics, Maxi-Switch and BTC. All have a rubber-like membrane beneath the keys. That's why they feel spongy. No sound, no sensation. Just a mushy feel and a distant "thunk" as the key hits bottom.

We searched the world three years to find the ideal keyboard. With the feel, sound and touch of an electric typewriter. Whose keys give a solid, positive entry. WE FOUND IT! And now it's standard with all Northgate XTurbo and ATurbo Systems.

OUR CUSTOMERS TOLD US "SELL THESE KEYBOARDS" TO EVERYONE!

To our delight, buyers of our systems* began buying our "C/T" keyboards to replace those they purchased before they discovered Northgate quality and value. It was these customers who suggested we offer the new "C/T" Keyboard to all PC users looking for a better keyboard.

*Ask about the New Northgate ATurbo — a complete 16MHz 486SX Hard Drive System \$1799.00

TRY THE NORTHGATE "C/T"... YOU'LL FEEL THE DIFFERENCE.

Plug the Northgate "C/T" into your system. Press a key. WOW! At first touch you know this is it! The key passes detent at center position with a slightly audible "click." Sound and change in tension tell your fingers you've made an entry. As the key bottoms, a more positive click confirms the entry and signals the finger to release and hit another key. Touch typists love it.



In actual typing tests, speed increased by up to 28 percent with a 16 to 20 percent reduction in errors. Besides making typing enjoyable again, the increase in production you will get with the "C/T" should be enough reason to replace all your keyboards!

Enhanced 101-key Model

ONLY \$99.00

(Compatible with XT or AT)

Standard 84-key AT Style

Only \$79.00

STANDARD 84-KEY MODEL:

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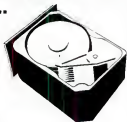
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BEST AND WORST OF 1987 Twenty editors and authors merge personal insight with product evaluation in this retrospective of the best (and some of the worst) of 1987. Over 60 products get the nod, including a nifty spreadsheet lionized by contributing editor Jim Seymour, executive editor Paul Somerson's favorite laptop, a scholar's word processor for the rest of us, and more. Then executive editor Bill Howard puts the year in perspective with his favorite computer-industry bombs and blooper.

AWARDS FOR TECHNICAL EXCELLENCE Technical innovation in the service of increased corporate and personal productivity is the great engine that drives the computer industry. In its Fourth Annual Awards for Technical Excellence presentation, *PC Magazine* honors the engineers, designers, and products that powered that engine through 1987.

COMMUNICATIONS Getting data from here to there is the job of every communications and data transfer package—but some do it better than others. Author Bruce Brown tests the data transfer capabilities of *Lap-Link*, *The Brooklyn Bridge*, and seven of their competitors, while contributing editor M. David Stone puts five top communications packages through their paces: *Crosstalk Mk.4*, *HyperAccess*, *PC-Talk4*, *ProComm*, and *Smartcom III*.

COMPUTERS Tandy has filled out its 1000 series of PCs with the \$699 8088-based 1000 HX and the \$1,199 286-based 1000 TX. Contributing editor Richard Aarons gets under the hood of the new offerings with thorough benchmark testing and features analysis to report on the true price/performance rating of each machine.

CONNECTIVITY Fiber-optic cabling is the most secure and reliable lifeline for LANs. Contributing editor Frank J. Derfler, Jr., tests and evaluates four systems that currently make use of fiber optics either in whole or in part: ARCnet, Code-net, ProNET-10 p320x, and 10-NET.

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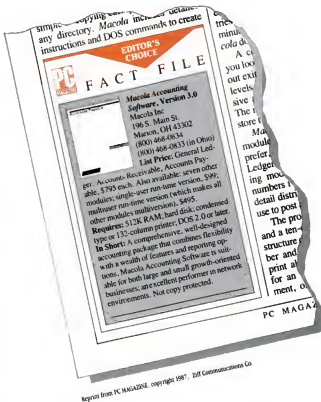
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AFTER HOURS

ART & LEISURE

'Twas the Night Before Christmas And a Warm EGA Glow Filled the Room . . .

BY JONATHAN MATZKIN

Santa Claus has been a pretty consistent guy over the years. His image—red suit, white beard, prosperous figure—has been durable and reassuring. But that unchanging exterior hasn't kept Santa from adapting to the latest media developments.

His movie career peaked with a boffo performance in *Miracle on 34th Street*, and he made the jump to television with a hero's role in "Rudolph the Red-Nosed Reindeer."

Old Saint Nick must have a sharp agent, because once again the jolly one has found his way into a new technology—a PC graphics display.

'Twas the Night Before Christmas is a novelty disk that dramatizes Clement Clarke Moore's classic holiday poem in full-color animation and sound. The \$8.95 entertainment tells the traditional story of the cozy home that Santa visits via the chimney on Christmas Eve.

The disk was prepared by MicroStar Graphics, publishers of *PC Life*, a slick, disk-based magazine (see *PC Magazine*, After Hours, Volume 6 Number 20). *'Twas the Night Before Christmas* has the same graphic look and feel as the magazine, because, like *PC-Life*, it was generated with *Show Partner FIX*, a presentation graphics and animation package from Brightbill-Roberts (see *PC Magazine*, Volume 6 Number 5).

The animation is not Saturday-morning-cartoon quality, but it's very attractive and effectively dramatizes the poem. The text of the poem scrolls by beneath the moving images. Users



'Twas the Night Before Christmas is one of the best bargains around. If you're looking for attractive graphics.

can start and stop the story at will, using the cursor Up and Down keys.

Appropriate Christmas music accompanies the narrative, but as heard through the PC's tinny speakers, this otherwise inspirational music is grating. Mercifully, you can toggle the music on and off, which should make for less-frazzled adult nerves in homes where kids play the disk over and over.

In addition to the story, there are several interactive features that make this disk a good value for its modest cost.

Youngsters can write a letter to Santa using the disk's built-in text editor, and the missive can be printed out with Santa's North Pole address automatically included.

The disk has a Christmas puzzle game and will also generate a simple greeting card. The *'Twas the Night Before Christmas* story can be freely copied and distributed to other PC-equipped holiday revelers.

'Twas the Night Before Christmas would make a great gift for any child big enough to reach the keyboard.

List Price: *'Twas the Night Before Christmas*, \$8.95. **Requires:** 256K RAM, one disk drive, graphics adapter. Simon and Schuster, One Gulf + Western Plaza, New York, NY 10023; (800) 624-0023, (800) 624-0024 (in N.J.)

CIRCLE 646 ON READER SERVICE CARD



HOBBIES

Holiday Art Without Scissors and Glue

BY GUS VENDITTO

The *Microsoft Windows* environment may not come immediately to mind when the family starts to plan traditional party decorations and greeting cards.

But, why not? *Holiday Clip Art*, part of Micrografx's series of *Windows-compatible* art libraries, has drawings of Christmas tree ornaments, Santa Clauses, Bethlehem scenes, even New Year's Eve reveling on disk, ready for importing into *Windows Point*, *Windows*

Draw, or *PageMaker*. They're as good as anything you'll find on traditional greeting cards. To be honest, most of the images are what we used to call "square" (as in "L-7")—but it's the holidays. You don't want your kids sending Christmas cards that look like the cover of the latest Twisted Sister album. You want traditional values, tastefully rendered.

The \$49.95 *Holiday Clip Art* library comes with over 100 drawings that cover all the seasons, from April Fool's Day to Thanksgiving.

You can buy it individually, if you've got a *Windows-compatible* paint program, but if all you want to do is use the images in *PageMaker*, you'll need *Portfolio*, which gives you a viewer that can break up the libraries into individual .PIC files. *Portfolio* comes with a *General Clip Art* library; make sure you request the *Holiday* library when you order, since it's merely one of many libraries Micrografx offers as a free selection when you purchase *Portfolio*.

List Price: *Portfolio*, \$99.95, including *General Clip Art* and *Holiday Clip Art*; *Holiday Clip Art*, \$49.95. **Requires:** *Microsoft Windows*. Not copy protected. Micrografx Inc., 1820 N. Greenville Ave., Richardson, TX 75081; (800) 272-3729.

CIRCLE 644 ON READER SERVICE CARD



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There's also Ad Lib Visual Composer™, about the most instinctive composition software ever devised. Simply draw lines to indicate notes, using the on-screen piano keyboard as a guide. Change instruments, tempo and volume with a couple of keystrokes. Cut, copy and paste portions of your music in a snap.

Included with the program is Composition Projects™ #1, a step-by-step guide to creating all kinds of music, including classical, jazz, bossa nova, ragtime, and more. Just the thing for an ever-expanding repertoire.

Visual Composer is worth \$89.95 if purchased separately, but it's yours free when you buy the system.

Then play back all of your creations, as well as several pre-programmed selections, on the Juke Box™ playback software, also included with your system.

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AFTER HOURS

Flight Simulators

(continued)

instance, which you feel has to be hauled into the air and made to climb through willpower, and jump into the F-18, which can be pointed straight at the moon until the atmosphere thins and she begins to feel like the Spad.

Navigation aids are limited to a satellite view and a radio, both of which give readouts on the distance and direction to the primary airfield.

From a menu you can elect to receive instruction from the great Chuck Yeager himself. At first, in awe, you will simply observe while he does all the work. Then you take control, following instructions that appear at the bottom of the screen and on the Heads-up display.

General Yeager is not the most observant of instructors. If he says "advance throttle to 100%" and you fail to do so, he just continues with the next instruction. You can sit silently in the hangar while he chatters away, twitching his stick to correct imaginary wobbles and lining up nonexistent horizons. But he's quick to spot a crash—which will summon his familiar face, together with an appropriately pithy comment like, "Nice auger-job. How about going back to ground school?" That feature can become a little grating if you've just failed, for

the fifth time, to land one of the experimental planes that has the gliding characteristics of a brick. Through clenched teeth you suggest that he cut out the smart remarks and tell you what you're doing wrong. Then you remember who you're talking to and add, "sir."

Jet

With the arrival of *Advanced Flight Trainer*, *Jet* comes perilously close to being relegated to "game" status. Although it can share the scenery disks of *Flight Simulator*, it has no navigating capability and you'll quickly become lost in the air.

You're offered a choice of two jet aircraft to fly: a carrier-based F-18 or a land-based F-16. In either you can dogfight with enemy aircraft or strike enemy targets. A number of features justify classifying *Jet* as a simulator. Between missions you must return to base to refuel and rearm. When you fly the F-18, your base is the postage-stamp-sized deck of an aircraft carrier, and considerable skill is required to land. You have the option of observing your aircraft from the carrier, making it possible to eject yourself from your own F-18.

The demo mode is entertaining but bears little resemblance to the manner in which you will actually conduct a dogfight. If you are aggressive in anything



F-15 Strike Eagle's level of difficulty is raised as your skill grows; it's closer to being a fighter-pilot game than a flight simulator.

but practice mode, you'll spend a lot of time dangling under a parachute while your plane spirals down after a hit from a heat-seeking missile. Far worse, *Jet* seems to suffer from the same washed-out colors as its stablemate, *Flight Simulator*.

F-15 Strike Eagle

F-15 Strike Eagle does not pretend to provide the sensation of flying, to teach navigation, or to take you on a sightseeing tour. It follows the classic game format of progressively more difficult scenarios.

Once you've learned which keys do what, you plunge into battle. Early frustration gives way to occasional satisfaction as your skill level rises. The documentation describes the F-15 Strike Eagle cockpit as a "complex and stressful working environment," and that is an understatement.

The stress is heightened—deliberately, I suspect—by the fact that the aircraft, its armaments, and its defenses do not respond to every keystroke. Getting to the primary target seems a lot easier than fighting your way out. Stubbornness keeps you coming back for more. You can get hooked on this one.

The New Hierarchy

Although Chuck Yeager's *Advanced Flight Trainer* is a new addition, I'm sure it will

join *Flight Simulator* in providing occasional therapeutic relief at the end of a long day. When I have aggressions to work off, *Jet* or F-15 will do the trick.

List Price: Microsoft *Flight Simulator*, \$49.95. **Requires:** 64K RAM, DOS 2.0 or later. Copy protected. Microsoft Corp., 16011 NE 36th Way, Redmond, WA 98073; (206) 882-8088.

CIRCLE 646 ON READER SERVICE CARD

List Price: Chuck Yeager's *Advanced Flight Trainer*, \$39.95. **Requires:** 256K, graphics adapter; DOS 2.0 or later. Copy protected. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

CIRCLE 648 ON READER SERVICE CARD

List Price: *Jet*, \$49.95; Scenery Disks, \$19.95 to \$24.95 each, complete set, \$99.95; Star Scenery Disks, \$24.95 each. **Requires:** 59K RAM, DOS 2.0 or later. Copy protected. Sublogic Corp., 713 Edgebrook Dr., Champaign, IL 61820; (217) 359-8482.

CIRCLE 647 ON READER SERVICE CARD

List Price: F-15 Strike Eagle, \$34.95. **Requires:** 128K, RAM, CGA, DOS 2.0 or later. Copy protected. Microprose, 120 Lakefront Dr., Hunt Valley, MD 21030; (301) 771-1151.

CIRCLE 646 ON READER SERVICE CARD



Enemy planes fly quickly past your screen in *Jet*; you can choose to command a land-based F-16 or an aircraft carrier-based F-16.



Fun For The Entire Family



Available on IBM 2364,
(EGA CGA 32mb)
Macintosh and
Amiga coming soon

SOLITAIRE ROYALE

Solitaire doesn't necessarily mean you play alone. Eight kinds of solitaire are presented in a unique and entertaining format to be played individually or competitively. Choose from 10 beautiful card decks. For the children, three additional games are included. It's a "must see" product and one you'll play for years!



IBM EGA version



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Commodore 64
IBM 2364,
and Apple II 128K

SOKO-BAN

This maze strategy game will capture your interest the first time you play. Your challenge is to solve 50 levels of increasingly difficult mazes, then create an infinite number of mazes yourself with the option to save 49 of them at a time. Number of moves and pushes plus time elapsed are important factors in scoring. Improve upon your scores each time you play.



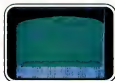
IBM version



Available on
Apple II 48K
and IBM 2364

LUNAR EXPLORER

You are in control of a lunar landing vehicle. While exploring the moon and investigating all its rills and craters, take time to marvel at "out the window" views of constellations, the Earth rising over the lunar horizon and the Apollo 11 landing site. Eight exercises are available to learn piloting maneuvers. Scores measure accuracy of navigation and efficiency of fuel consumption.



Apple II version



Available on
Apple II 48K
and IBM 2364

WILDERNESS

Spice up your life with adventure; your plane has crashed in a desolate area high in the Sierra Nevada. Relying on your wits, a few supplies, and any natural resources available, attempt to find your way to the ranger station. The comprehensive survival guide included could save your life in this computer adventure and could provide useful tips for your real-life adventures!



Apple II version

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CIRCLE 522 ON READER SERVICE CARD

AFTER HOURS



GAMES

Simulating the Joys of Flight: Four Ways to Feel Like You're in the Air

BY GEOFF DAW

About 4 years ago I stuffed my Commodore 64 into a shopping bag and took it on the rush-hour subway to my office. I hooked it up to the corporate TV in the boardroom and tried to convince skeptics that even a "toy" version of a personal computer could run rings round us in parts of our jobs. They dutifully oohed when a spreadsheet recalculated a financial plan and aahed when a database manager sorted records and prepared a report. I like to believe that that demonstration advanced by weeks the day our first PC was installed.

Of course, what advanced it by months was my demonstration of *Microsoft Flight Simulator*. The realism and complexity of the simulator caught the imagination of my coworkers.

The Commodore and the tight little spreadsheet program and database manager have long since been replaced by an AT,

I-2-3, and dBASE. I still miss the linked spreadsheets and the result fields in the database on the Commodore, but most of all, I miss the brilliant colors and realistic propeller sounds in *Flight Simulator*.

Other programs featuring simulated flight have appeared, earning the right to be compared with the original. They include *Jet*, *F-15 Strike Eagle*, and the newest, *Chuck Yeager's Advanced Flight Simulator*.

Microsoft Flight Simulator

Microsoft Flight Simulator presents a display whose lower half is crammed with dials and instruments. Your Cessna is on Chicago's Meigs Field, fueled and ready to go. You can see the runway stretching invitingly ahead and, beyond, the clear blue sky. Acknowledging the impatience of most of us, Microsoft gives instructions early in the manual for a quick test flight. So within minutes you can be banking, diving, and soaring. The fact that you're instructed to end your first flight by plunging into the ground should tell you that subtleties are not learned easily.

Learning, with the help of the comprehensive instructions, is a step-by-step affair, with each level of expertise bringing its own satisfaction. Once you are airborne, things happen at a



When you fly Chuck Yeager's *Advanced Flight Simulator*, you're more likely to enjoy maneuvering the plane, rather than covering countryside.

fairly leisurely pace so there is usually time to refer to the manual during a maneuver. A major milestone is the ability to land in one piece most of the time. When you begin to insist on touching down at an airport, albeit across the runway or in the baggage claim area, you know you are getting good.

Soon the romance of cross-country flight beckons, and you'll need to learn what those two navigation radios are all about and how they fit in with the charts provided in the back of the manual. It is a soulless pilot who will not smile with satisfaction after a 3-hour flight as the runway of his destination rises gently to meet him. The smile will be wiped off seconds later by a crunch, accompanied by the smug on-screen recommendation to "lower your gear next time."

When flights in perfect conditions begin to lose their challenge, you can spice them up by changing the season and time of day—or night—or you can place cloud layers right down to the deck, so that you truly need the Instrument Landing System (ILS) available at some airports. If you really want to confuse your navigating, set strong winds in different directions at different heights, and add a dash of turbulence here and there if your stomach can stand it.

The program disk provides you with four areas in which to

fly: the "home base" Chicago area, New York/Boston, Seattle, and Los Angeles. With about a hundred airports to visit, you can build your flying hours with plenty of variety. When you want to see the rest of the country, you can buy any of 12 separate "Scenery Disks" (sold by SubLogic Corp.).

After hundreds of hours in the air, I still enjoy flying and navigating *Flight Simulator's* empty skies. I still miss those pure colors, though. I cannot run it with an EGA—I get a kind of blue wash with no details at all. Full enjoyment of this program requires a considerable investment of time. But it's time well spent.

Chuck Yeager's Advanced Flight Trainer

The newness of this software is immediately apparent from its crisp graphics and clear pop-up and pull-down menus. Sensibly, its main controls are the same as *Flight Simulator's* so you can be in the air in moments.

In this simulator the emphasis is on planes and flying rather than navigating and sightseeing. Fourteen different planes are available for sampling, from World War I biplanes like the Camel to the World War II P51 Mustang to the World War III SR-71. Each plane has a distinct personality, and it's fun to climb out of a Spad biplane, for



Microsoft Flight Simulator's screen is not the most interesting of the flight simulators, but its feeling of control is the most exhilarating.

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At which point, you may want to lie down.

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GAMES

Marble Madness: A Stocking Stuffer That May Keep the Kids at Home

BY JOHN C. DVORAK

With Christmas around the corner, it's time to consider buying a game or two for the computer user in your home. The problem is that the IBM PC may be the worst game machine ever invented. It doesn't hold a candle

They just know it's true, that's all. Besides that, the EGA is a clunker of a display, too, they tell you. Game makers also complain about the slowness of the PC, lack of decent sound, poor mouse interface, and lack of a joystick (it has to be added and too few people have both-



Marble Madness challenges you to keep your ball on the right track. The game will replace marbles that you lose, until you run out of time.

to the Apple II, the Atari, the Mac, and even the cheapest Commodore.

Part of this problem stems from the insistence of game designers on using the lowest common denominator—the CGA graphics standard—for the display. This results in a clunky low-resolution image that is, at best, a throwback to the worst of the home video game systems popular years back. When you talk to the designers about this, they tell you that they design for the CGA because they don't think enough people have EGAs. None do any research to conclude this.

ered).

When you find a game to play and compare it with the hot games on other machines, you quickly realize that the IBM will never be a decent machine for action games. Even when a fairly good game is moved to the IBM PC environment, the user becomes either bored, irritated, or disillusioned. This is certainly the case with *Marble Madness* from Electronics Arts.

First of all, *Marble Madness* is just no damn fun without a joystick. With a joystick it isn't much more fun, but at least it's playable.

The idea behind the game is

that you control a marble in a three-dimensional angular environment where the marble wants to roll off into never-never land. Your job is to maneuver the marble up and down hills and valleys to its final destination, which is the next screen.

Marble Madness comes on two disks. Within a few minutes any user can navigate through all the mazelike screens on Disk One. Since the game is copy protected and uses its own screen and keyboard drivers, the user must continually pull Disk One out of the drive and insert Disk Two. This gets old fast. Pretty soon the user quits and says the heck with it. This happens with most PC action games.

This effect is a shame, because action games can be a thrill and a form of therapy for the bored PC user. It's a form of sport, no matter what they say. Action games require quick thinking and keen hand-eye coordination. There's nothing wrong with improving those skills, even if the only net result is to punch up a phone number more speedily.

But it's simply too frustrating to improve those skills if the PC is the middleman. All that's

AFTER HOURS INDEX

Marble Madness

Best with a joystick
Stuff a Stocking with a
Flight Simulator
Microsoft Flight Simulator; Chuck Yeager's Advanced Flight Trainer; Jet: F-15 Strike Eagle
'Twas the Night Before Christmas
A different vehicle for a familiar message
Holiday Clip Art
One way to avoid crayons, finger paints, and glue

left to the PC user, if this game situation isn't remedied, are wordy adventure games and slow-moving simulations such as computer checkers. A lot of power is going to pot here.

List Price: *Marble Madness*, \$39.95 **Requires:** 256K RAM, CGA; joystick recommended. Copy protected. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

CIRCLE 650 ON READER SERVICE CARD

A Joystick: It's Only Part of the Solution

To function as a decent game machine, the PC requires a joystick adapter and a joystick. Figure to pay \$45 for each. Most of the action games for the PC allow the use of the keyboard as a substitute for a joystick. *Marble Madness* does this. While one or two games in a million perform better with keyboard input, most games are nearly impossible to play without a joystick.

Note: All joysticks aren't the same. You're better off if you have some friends with some joysticks hooked to their machines, so you can test the various attributes of the different joysticks. Each brand has slightly different characteristics and personalities—just like people. (See *After Hours*, Volume 6, Number 16, page 478, for help in choosing.) Today's PC is incomplete without a joystick and a mouse attached. You should have both. —John C. Dvorak

print "Merry Christmas"
end

```
#include <stdio.h>
void main ()
{
    printf ("Merry Christmas\n");
}
```

WORLD SMALL
CLOCK HIGH
MerryChristmas\$
CLOCK
DGROUP
xmas
4ch
start



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PC AI Magazine (comparing QuickC to Turbo C), Fall
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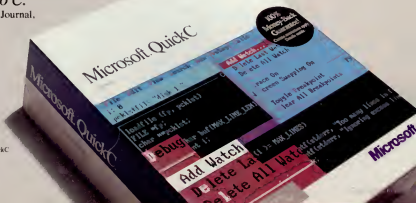
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Alan Holub, Dr. Dobbs's Journal,
October 1987.

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